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THE ILLUSTRATED
INTERNATIONAL AIRCRAFT GUIDE

GENERAL AVIATION

MICHAEL F JERRAM AND CLIFF BARNETT
Consultant BILL GUNSTON

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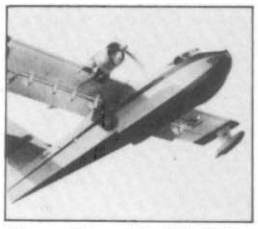


Cover: Canadair CL-215

This book contains some of the most workmanlike aircraft ever built. These include crop-sprayers, ambulances, utility aircraft, such as the Polikarpov Po-2, and light transports which can carry anything from people to livestock.

General Aviation aircraft have remarkably long service lives; they may be fitted with improved engines, avionics and have stretched airframes, but the basic design remains the same. Some, like Rockwell and Beechcraft designs, have been in service since the 1940s and 50s and have been through four or five variants.

Contents

Po-2, Polikarpov

FIRST FLIGHT 1927

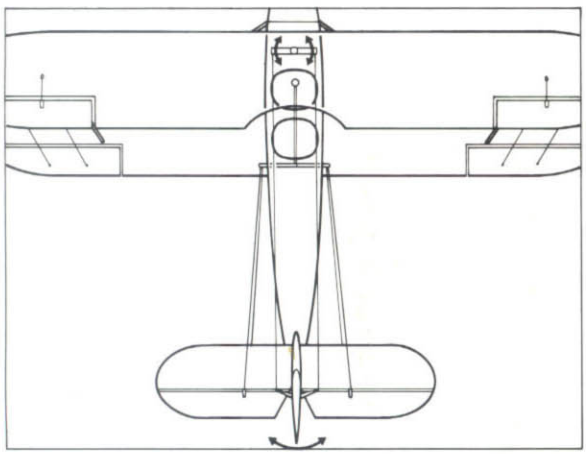
THE Polikarpov Po-2 was designed in 1926 by the young Russian aeronautical engineer Nikolai Polikarpov. It was intended as a light training biplane and had a fabric-covered wood/metal airframe and was powered by a 100-hp M-11 five-cylinder radial engine. The first aircraft refused to fly at all during tests and was extensively redesigned and put into series production as the U-2 (later redesignated Po-2 in honour of its designer).

The U-2/Po-2 was ordered in quantity and remained in production from 1928 until 1952 in the Soviet Union and Poland, where it was known as the CSS 13. The total number built is unknown, but is believed to be in excess of 40 000 aircraft, which makes the Po-2 one of the world's most produced aircraft, along with the Ilyushin Il-2 and Il-10 (41 400) and the Yakovlev Yak-1, -3, -7, and -9 (37 000).

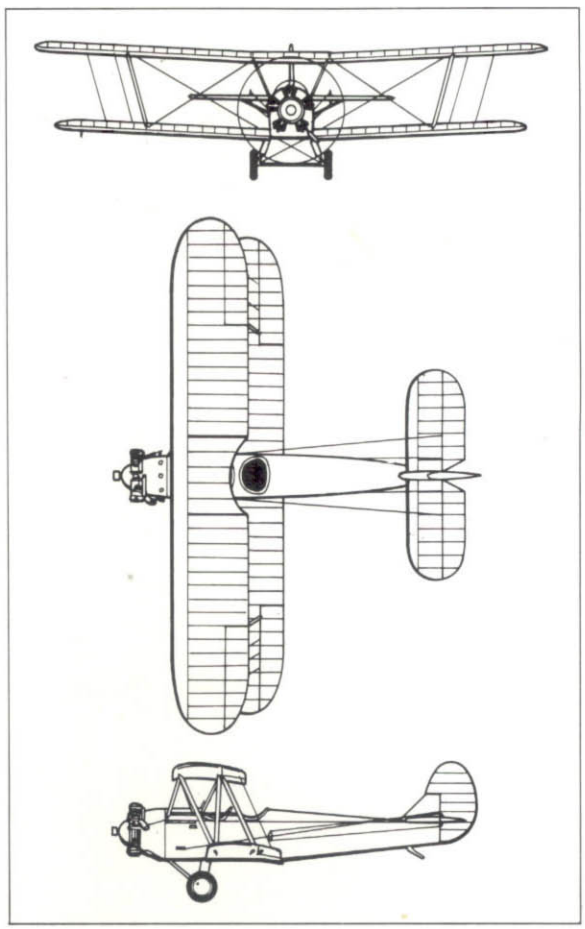
The U-2 biplane made history in 1938 when an aircraft piloted by G Vlasov located a team of Russian scientists who had been drifting on ice floes in the North Pole for nine months.

Few, if any, other aircraft have fulfilled as many widely varying roles as the Polikarpov Po-2, which has served as a trainer, sportsplane, liaison aircraft, artillery spotter, parachute dropper, glider tug, air ambulance, transport, reconnaissance aircraft, light bomber, ground-attack aircraft, floatplane, skiplane and agricultural aircraft, – the last role gaining it the designation Po-2AP and name of *Kukuruznik* (corn cutter). The fire-fighting version was named *Lesnik* (forest guard). Some were modified by the addition of a cabin for use in the light transport role, or as an air ambulance.

The Soviet State airline Aeroflot used thousands of Po-2s for crop-dusting and spraying. In Russia the aircraft became known as the 'sewing machine' because of the distinctive note of its M-11 engine. Although designed as an open-cockpit aircraft, cabin versions were built which could accommodate two passengers or stretcher cases behind the pilot's position. When the Air Standards Co-ordinating Committee of NATO met in 1954 to agree on a system of reporting names to identify Soviet aircraft types, they chose the appropriate name of Mule. Production was then ending. But Po-2s still fly with clubs in the USSR, China, Czechoslovakia, Poland, Romania and Yugoslavia.



Top: The Polikarpov Po-2 Mule is still in use more than 50 years after its first flight. Known popularly as the Kukuruznik (Corn Cutter) it served throughout the war and is now used for ambulance, air-taxi and survey work. Most versions in service today are Polish-built
Above: The simple controls on the Po-2; though these are crude by modern standards they are easy to maintain and make the Po-2 a good training and utility aircraft which can be flown by comparatively unskilled pilots



Po-2

Type: training, liason, utility, agricultural and ambulance biplane
Maker: State Industries, USSR
Span: 11.4 m (37 ft 5 in)
Length: 8.15 m (26 ft 9 in)
Height: 2.92 m (9 ft 7 in)
Wing area: 35.4 m^2 (381 sq ft)
Weight: maximum 981 kg (2163 lb); empty 608 kg (1340 lb)
Powerplant: one 110-hp M-11 radial piston engine
Performance: maximum speed 149 km/h (93 mph); range 530 km (329 miles)
Crew: 2
Production: minimum 40 000 estimated

FC.2, Fairchild

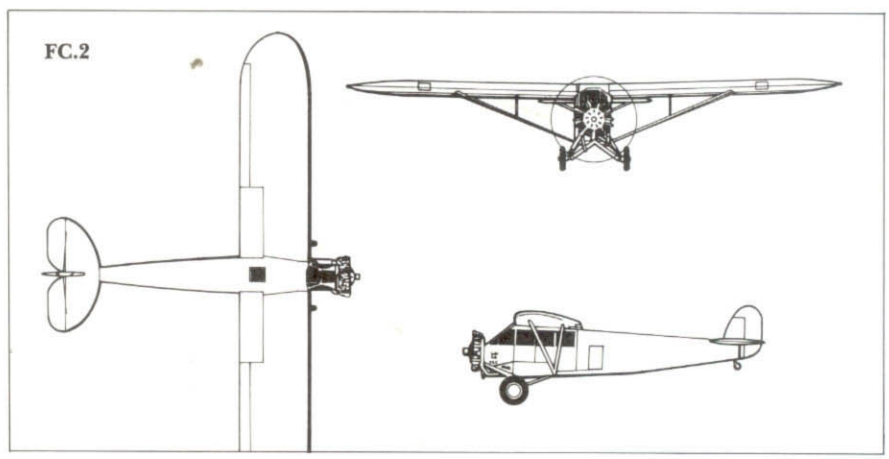
FIRST FLIGHT 1927

THE Fairchild Airplane Manufacturing Company was founded by Sherman Fairchild in 1925 and two years later production began of the FC.2 light transport aircraft. It was powered by a 220-hp Wright Whirlwind radial engine and could carry four passengers at a speed of 185 km/h (115 mph). The FC.2 was a pioneer American airliner and was used by Pan American Airways for their first airmail service between Key West, Florida and Havana, Cuba on October 19, 1927.

From the FC.2 was developed the more powerful Fairchild FC.2W, powered by a 450-hp Pratt & Whitney Wasp engine. This tough, reliable aircraft became a mainstay of North American airline operations in the late 1920s. A high-wing monoplane of mixed wood and metal construction, it served airlines such as Pan American, PANAGRA (Pan American Grace) and Colonial Air Transport on passenger, mail and cargo routes throughout the Americas. One FC.2W was used by Bell Telephone Laboratories for early experiments in airborne radio communication; another was selected by John Henry Mears and Captain Charles Collyer for their 1928 round-the-world flight. The Fairchild, named *City of New York*, set off from New York on June 29, 1928 and completed the circumnavigation in 23 days 15 hours 21 min.

The Fairchild Model 71 was a 1928 development of the FC.2W with the same Wasp engine, but with accommodation for six passengers. Folding wings and interchangeable float, ski or wheel undercarriages were offered. A subsidiary company, Fairchild Aircraft Limited, was established at Longueuil, near Montreal, Canada in 1929 to manufacture the aircraft which was widely used in Alaska with Pacific Alaska Airways and in Central America by Pan American Grace Airways. A metal-skinned version of the Fairchild 71 was produced in Canada as was the improved Model Super 71, which was the first aircraft of original design to be built by the Canadian company. Unlike the previous model it featured a parasol-mounted wing with the pilot's cockpit removed to the rear of the trailing edge behind the six-seat passenger cabin. A ten-seat aircraft, the Fairchild (Canada) 82-B, was designed to meet the needs of Canadian bush operators in 1935.

In the draft of civil aircraft which took place in World War II, the USAAF took charge of three 1928 Model FC-2W-2s.



FC.2W

Type: utility and cargo aircraft
Maker: Fairchild Engine & Airplane Co
Span: 15.24 m (50 ft)
Length: 9.45 m (31 ft)
Height: 2.74 m (9 ft)
Wing area: 17.1 m^2 (184 sq ft)
Weight: maximum 2087 kg (4600 lb); empty 1097 kg (2418 lb)
Powerplant: one 450-hp Pratt & Whitney Wasp radial engine

Performance: maximum speed 225 km/h (140 mph); range 1609 km (1000 miles)
Payload: seats for 4 passengers
Crew: 1
Production: 100 (FC.2, FC.2W); 90 (Model 71)

Top: A Fairchild FC.2 of Pan American Grace Airways (PANAGRA), which inaugurated a mail service in the late 1920s. This eventually linked the Canal Zone with Argentina via Chile and Peru
Above: A close-up of the Pratt & Whitney Wasp radial engine. The blister on the left of the cockpit is designed to give improved vision to the front and below – vital for rough airstrips or agricultural work

Robin, Curtiss

FIRST FLIGHT 1928

Left: A colourful Curtiss Robin seen at the Reno Air Races in September 1968
Below: The Robin in its more prosaic role as an agricultural spraying aircraft. The chemicals are fed into the tank aft of the cockpit and dispensed via the spray boom, with its wind vane valves on the leading edge

IN 1927 Curtiss developed a three-seat cabin monoplane for the expanding personal and private aircraft market. With a steel-tube fuselage and wooden wings it was a conservative design. The pilot was seated behind a stick with two passengers side-by-side to the rear of him.

The choice of engine was very surprising. This was the war-surplus 90-hp Curtiss OX-5. It was in fact once alleged that the Robin was produced just to use up Curtiss' stock of these old engines.

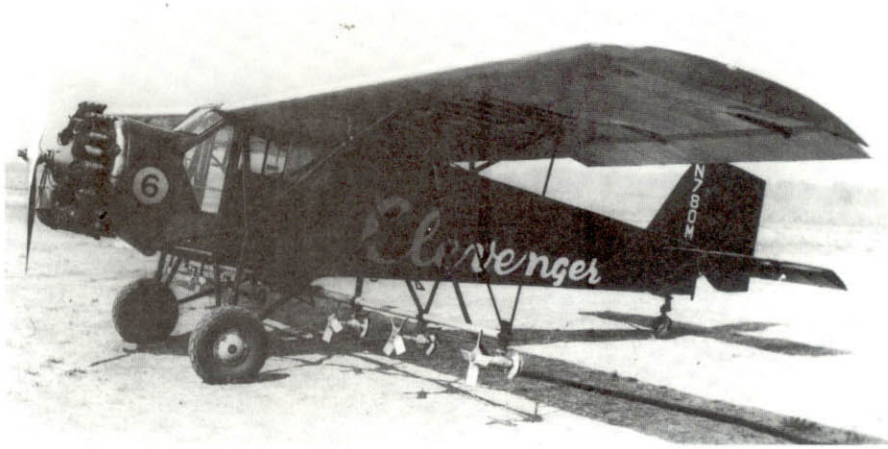
Another unusual feature of the early Robins were their wing struts. These used circular-section steel tube streamlined by the attachment of broad fairings which were supposed to act as aerofoils to produce lift. These were soon replaced with streamlined steel tubing. Early undercarriages used rubber-cord shock absorbers in streamlined boxes; these too were replaced – by oleo-pneumatic shock struts.

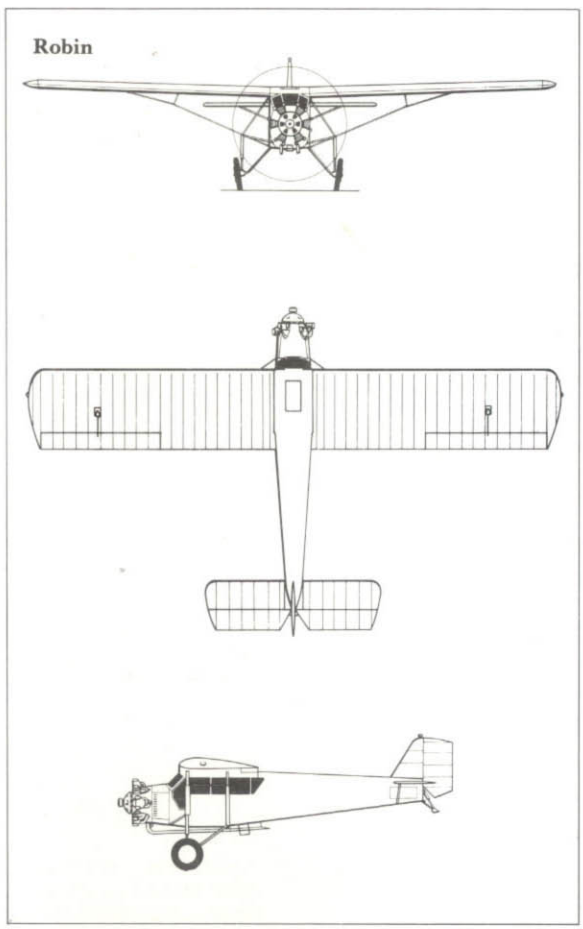
Four Robin prototypes were built and the first one flew in 1928. Curtiss produced 769 Robins, reaching a peak of 17 per week in 1929.

The Robin B was undoubtedly the most popular of the type, but in the depression of 1930 the price of these aircraft dropped to $2495. Other types of Robins were as follows: the Comet Robin, powered by a 150-hp Comet radial; the Robin B-2; Robin C, with 185-hp Curtiss Challenger engine; Robin C-1, the main Challenger-powered model; Robin C-2, with 170-hp Challenger; Robin CR, used to test the Crusader engine but never put into production; Robin W, with lower-cost engine; Robin J-1, J-2 and J-3; Robin M, converted Bs; Robin 4Cs, four-seat version.

Serving mostly as private-owner types, Robins broke the world's refuelling endurance record three times – 420 hours 21 min in 1929; 553 hours 28 min in 1930; and 653 hours 34 min in 1935. The most famous Robin was the former B model flown from New York to Ireland in 1938 by Douglas 'Wrong-Way' Corrigan. He had declared the intention of flying non-stop to Los Angeles, but turned east and flew the Atlantic instead.

Many Robins remained in service after World War II employed in roles such as crop-spraying and bush flying, where slow-flying capabilities were an asset. Nowadays, however, Curtiss Robins are cherished antiques. By 1980 some 40 were active in the US, making it the most numerous example of the few prewar Curtiss designs still flying.





Robin B

Type: cabin monoplane
Maker: Curtiss Aeroplane Co
Span: 12.49 m (41 ft)
Length: 7.83 m (25 ft 8½ in)
Height: 2.37 m (7 ft 9½ in)
Wing area: 20.71 m² (223 sq ft)
Weight: maximum 1107 kg (2440 lb); empty 668 kg (1472 lb)
Powerplant: one 90-hp Curtiss OX-5 V-8 air-cooled engine
Performance: maximum speed 162 km/h (101 mph) at 1525 m (5000 ft); range 772 km (480 miles)
Payload: seats for 2 passengers
Crew: 1
Production: approx 325

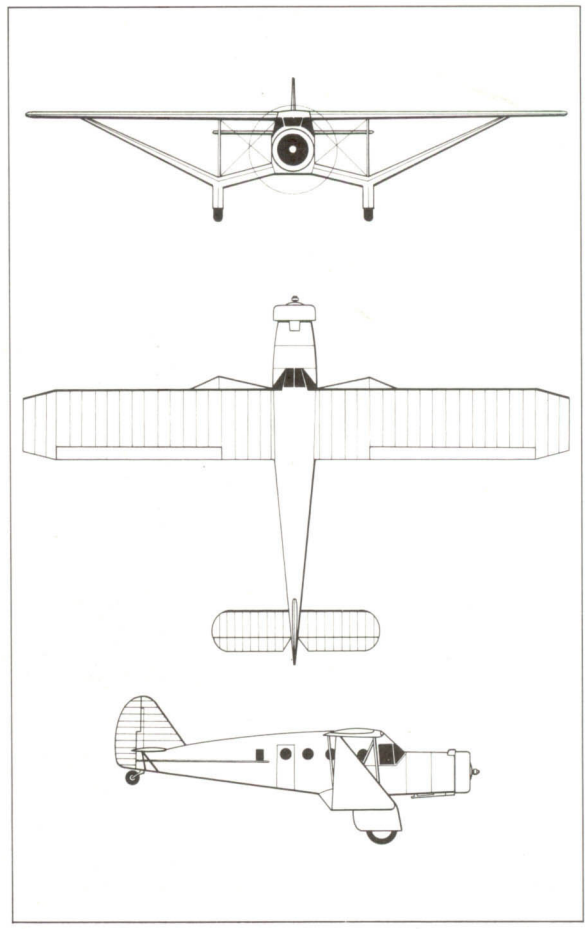
Bellanca AirCruiser

FIRST FLIGHT 1932

GIUSEPPE Bellanca arrived in New York from Milan in 1912 to seek his fortune in aircraft manufacture, having built (and crashed) his first aircraft in Italy in 1908. In 1917 he built America's first cabin monoplane which matured into the Wright-Bellanca *Columbia* in which Clarence Chamberlin and Charles Levine crossed the Atlantic from New York to Berlin two weeks after Charles Lindbergh's solo flight in 1927 (Bellanca had refused to sell the aircraft to Lindbergh on the grounds that he was an unknown pilot!). From the *Columbia* was developed Bellanca's first successful series production aircraft – the Model CH-300 Pacemaker which was produced between 1928 and 1935 in two models, one with a 330-hp Wright Whirlwind engine, the other (CH-400 Pacemaker Senior) with a 450-hp Pratt & Whitney Wasp. Both were six-seat cabin monoplanes distinguished readily by the airfoil-sectioned lifting struts which became a Bellanca trademark. One hundred and seven were built.

Produced concurrently with the Pacemaker, the Bellanca Model 31 Skyrocket was a more powerful eight-seat derivative first flown in 1930. Several Skyrocket models were produced, powered by radial engines of 450 to 550 hp. A cargo version was built in Canada after World War II by North-West Industries Ltd to meet the needs of Canadian bush fliers.

Two larger single-engined aircraft were also built by Bellanca in the early 1930s – the 15-seat Airbus which cruised at 241 km/h (150 mph), and the 11 to 14-passenger AirCruiser Model 66-75 which first appeared in 1932. The AirCruiser, with its wide airfoil section struts, was effectively a sesquiplane, and was used by many pioneering airlines in the United States. It became the backbone of small transport companies after the 1930 McNary-Watres Act stimulated interest in passenger-carrying by awarding payments to airmail carriers on the basis of their aircraft's load-carrying capacity, whether or not that capacity was actually used for mail. The AirCruiser was powered variously by 715-hp Wright Cyclone, 750-hp Pratt & Whitney Hornet and 875-hp Wright Cyclone radial engines, and was supplied to the Cuban Government in 1935 as a general purpose transport aircraft for the Cuban air force. In the 1930s Bellanca aircraft were renowned for their speed and comfort.



Top: The Bellanca AirCrusier with its wide airfoil-section struts was effectively a sesquiplane. It first appeared in 1932 and was popular both as a passenger carrier and mailplane
Above: A modified Pacemaker seen in the summer of 1972. Alterations include fitting floats and tapering the wing struts

66-75 AirCruiser

Type: passenger transport/utility aircraft
Maker: Bellanca Airplane Co
Span: 19.8 m (65 ft)
Length: 13.2 m (43 ft 4 in)
Height: 3.65 m (12 ft)
Wing area: 61.8 m^2 (665 sq ft)
Weight: maximum 5171 kg (11 400 lb); empty 2857 kg (6300 lb)
Powerplant: one 715-hp Wright Cyclone, 750-hp Pratt & Whitney Hornet, or 875-hp Wright Cyclone radial engine
Performance: maximum speed 265 km/h (165 mph); range 1143 km (710 miles)
Payload: seats for 14 passengers
Crew: 1
Production: not available

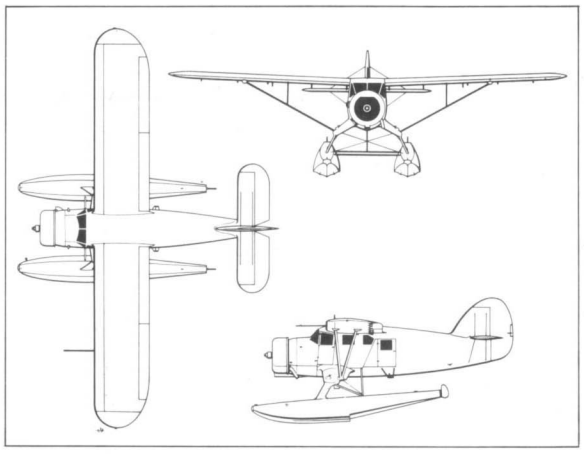
Norseman, Noorduyn

FIRST FLIGHT 1935

THE Norseman was a conventional high-wing monoplane with fixed undercarriage. Construction was a mixture of wood and metal covered with fabric. The fuselage was a welded steel-tube framework, a structure similar to that adopted for the tailfin, rudder and elevators, while the wings and tailplane were of wooden two-spar construction, again covered with fabric.

This aircraft was flown by the Canadian Car & Foundry Company but subsequently Noorduyn acquired the production rights. The wooden wing was replaced by a metal unit on a prototype, mated to a lengthened fuselage. Initially the type was powered by a Wright Whirlwind R-975-E3 radial engine rated at 450 hp, and in this form entered service as the Norseman Mk II, which was designed to fly with floats or skis in place of wheels. The usual propeller was a two-blade Hamilton Standard with three blades optional. Provision was made for eight passengers to be accommodated on removable bench-type seats or for six individual upholstered seats, or the cabin could be stripped bare for cargo.

Before World War II the type was flying in Mk II, III and IV forms with the Royal Canadian Mounted Police, Mackenzie Air Service and Dominion Skyways. The Norseman IV, which emerged in 1937, became the major production variant and was powered by a 600-hp Pratt & Whitney R-1340-S3H-1 Wasp nine-cylinder radial. The first of a number of Royal Canadian Air Force contracts came in 1940 when 38 Mk IVs were ordered as radio/navigational trainers. Seven examples were supplied to the USAAF as YC-64s, which later led to an order for almost 750 UC-64s. A few of these found their way to the US Navy, while six further examples were produced for the US Army Corps of Engineers equipped to carry six passengers.



Noorduyn Aviation stopped aircraft manufacture in 1946, its assets being taken over by the Canadian Car & Foundry Company. The new owner continued Norseman production until 1950, the final production variant being the Mk VI. The 1950s and 1960s saw bush operators in North America and small airlines throughout Central America, Iceland, Scandinavia, part of Africa, India and the Philippines operating more than 100 Norsemen.

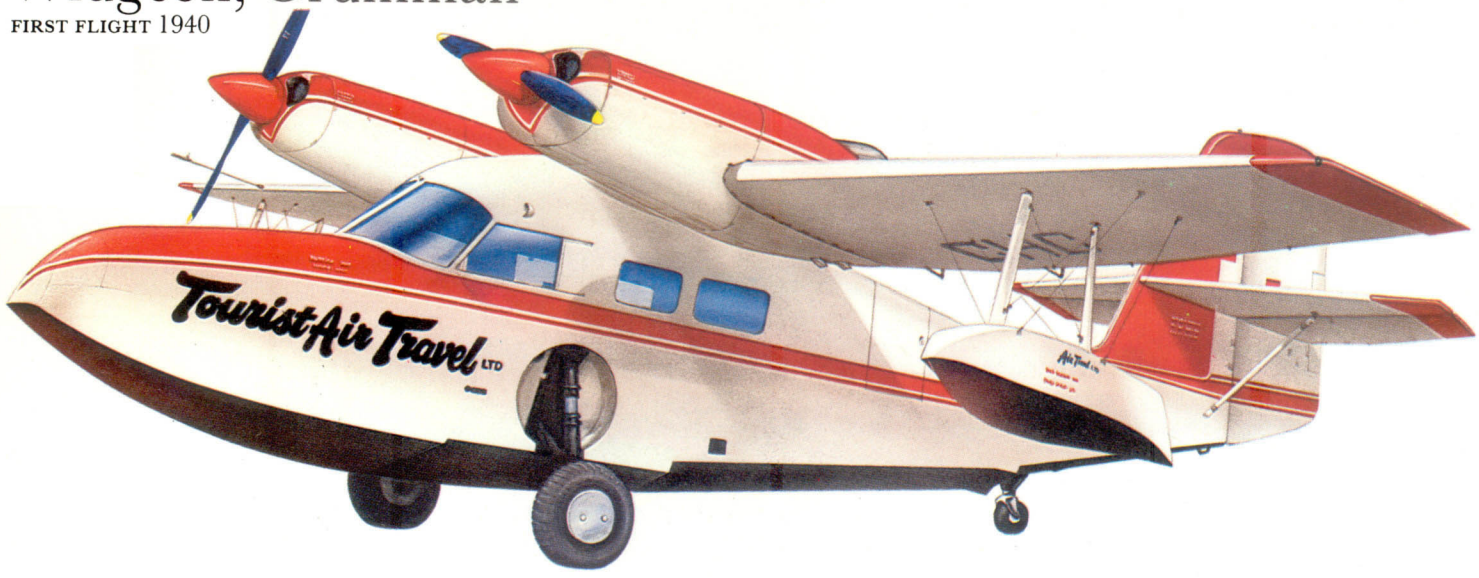
Norseman IV

Type: light STOL transport
Maker: Noorduyn Aviation Ltd
Span: 15.75 m (51 ft 8 in)
Length: 9.68 m (31 ft 9 in)
Height: 3.07 m (10 ft 1 in)
Wing area: 30.19 m^2 (325 sq ft)
Weight: maximum 3357 kg (7400 lb); empty 1928 kg (4250 lb)
Powerplant: one 600-hp Pratt & Whitney R-1340-S3H-1 or R-1340-AN-1 Wasp 9-cylinder radial engine
Performance: maximum speed 249 km/h (155 mph) at 1525 m (5000 ft); range 747 km (464 miles)
Payload: seats for 8 passengers
Crew: 1
Production: approx 900

Below: A Noorduyn Norseman of the Canadian operator Pacific Western Airlines. From modest beginnings in 1945, PWA has risen to be the third largest airline in Canada

Widgeon, Grumman

FIRST FLIGHT 1940



THE Widgeon is one member of a family of amphibian flying boats built in America by Grumman in the late 1930s and 1940s. Designated the G-44, the Widgeon first flew, before the US entry in World War II, in July 1940, some three years after its predecessor the Goose.

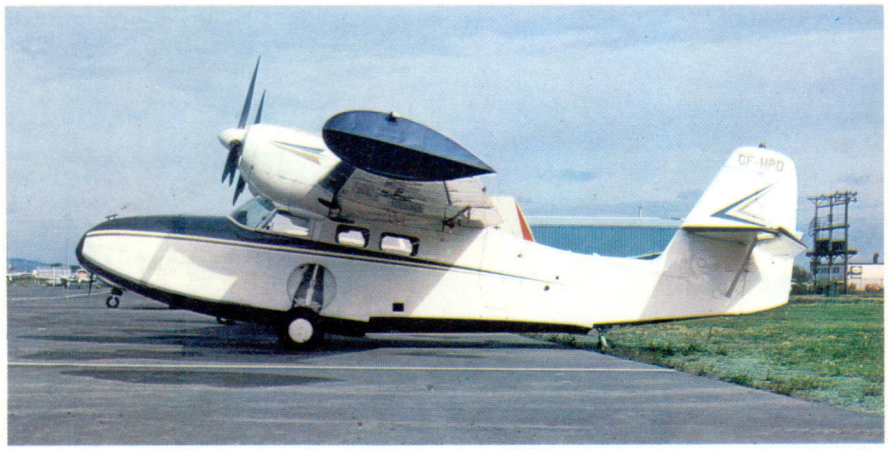
The type was designed to provide a four-seat amphibious transport for private and executive use, but the initial production examples were supplied to the United States Coast Guard Service for antisubmarine patrol work and as a three-seat utility transport which was designated the Grumman J4F-1.

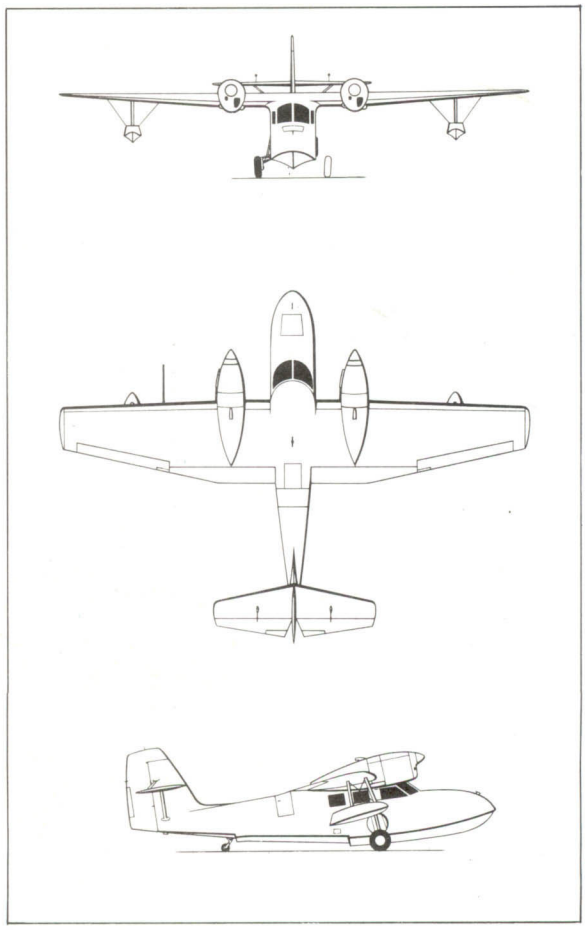
The 25 J4F-1s were followed by 16 OA-14s for the United States Army Air Force, but the most important version developed for military use was the J4F-2. After World War II a civil version designated the G-44A was developed, using a modified hull to provide better handling characteristics on water. Some 50 examples were eventually produced.

Many Widgeons no longer required for military service became available and were converted for airline or executive use, especially in North America. Short-range passenger services and sightseeing flights were flown by New Zealand Tourist Air Travel from Auckland in the mid 1950s until the late 1960s. The operation was taken over by Mount Cook Airlines, and this company flew them for a further six years.

The French manufacturer Société de Constructions Aéro Navalès produced 40 G-44As under licence both for the French navy and for civil use. The civil types were supplied to the United States, their French-fitted Mathis 220-hp engines being replaced by 300-hp Lycoming radials in a model which was known as the Garrett Super Widgeon.

McKinnon Enterprises, well known for conversions of the Grumman Goose, produced a model called the Super Widgeon featuring 270-hp Lycoming flat-six engines. More than 70 McKinnon conversions were built, with optional features including retractable wingtip floats and other extras. Three of the New Zealand Tourist Air Travel aircraft were converted to Super Widgeon standard by the installation of two 260-hp Continental engines. Widgeons were used in service by the air forces of Canada, Brazil and also by the Portuguese navy





Widgeon

Type: amphibian flying boat
Maker: Grumman Aircraft Engineering Corporation
Span: 12.19 m (40 ft)
Length: 9.47 m (31 ft 1 in)
Height: 3.48 m (11 ft 5 in)
Wing area: 22.76 m^2 (245 sq ft)
Weight: maximum 2055 kg (4525 lb); empty 1470 kg (3240 lb)
Powerplant: two 200-hp Ranger 6-440C-5 6-cylinder inverted inline air-cooled engines
Performance: maximum speed 257 km/h (160 mph) at 1525 m (5000 ft); range 805 km (500 miles)
Payload: seats for up to 5 passengers
Crew: 1
Production: 286

Top: a Grumman Super Widgeon of New Zealand Tourist Air Travel based at Auckland. These aircraft were used on short-range passenger services and sight-seeing flights
Above: A Canadian-registered Widgeon; the type is a useful taxi for towns based on the Great Lakes

Aerovan, Miles

FIRST FLIGHT 1945

THE Aerovan began life in 1944. Designer George Miles wanted to design a cheap low-powered freighter suitable for either military or civil purposes, which he also saw as a flying scale model for the larger types of freighter he was proposing. The result was a high-wing aircraft with external aerofoil flaps which was powered by two 150-hp Blackburn Cirrus Major engines. For easy freight-loading the entire rear of the plastic-bonded wooden fuselage was hinged to form a large loading door. The high tail boom was of all-metal construction and carried three fins and rudders. Since the Aerovan had a tricycle undercarriage there was ample headroom for loading freight underneath the tail boom.

From its first flight in 1945 the Aerovan flew and performed well, showing itself able to lift nearly 1016 kg (1 ton) of payload – a feat never before achieved with an aircraft powered by merely two 150-hp engines.

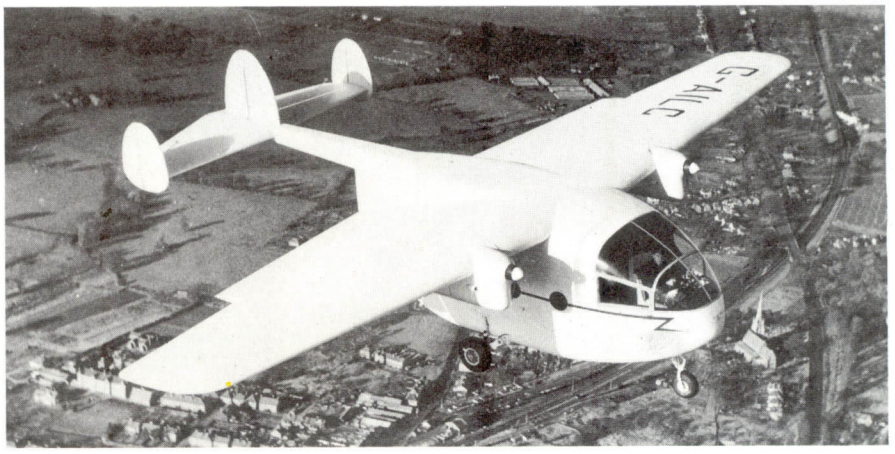
The production version had a slightly longer tail boom than the prototype and different-shaped windows, but otherwise no changes were made. Aerovans became popular in the UK and overseas and were used to carry all sorts of cargo, including animals. Standard Aerovans had two 150-hp Blackburn Cirrus Major III engines, one was fitted with two 145-hp Gipsy Major 10s, and another flew experimentally with two 195-hp Lycomings, with extra 20 mph and 50% improved climb rate.

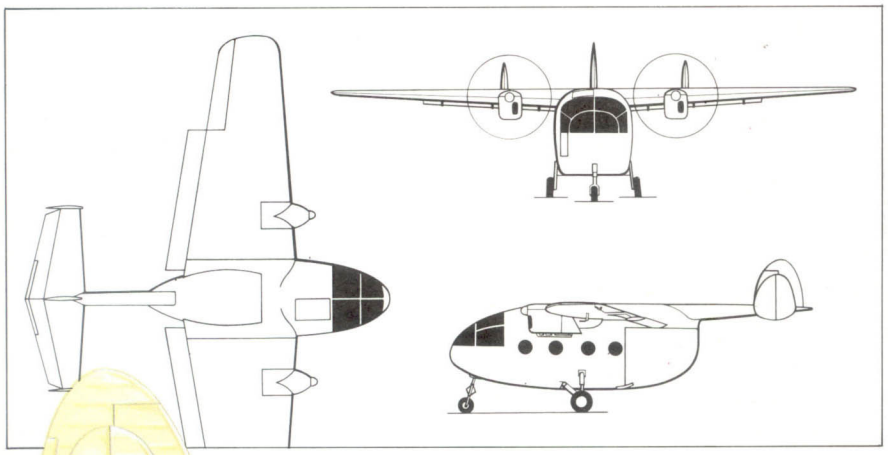
Aerovan experiments included carrying a mock-up of a nacelle for the Armstrong Siddeley Mamba turboprop engine, and fitting external aerofoil ailerons in line with the flaps. One Aerovan was also fitted with a very high aspect-ratio wing in the late 1950s.

One development, considered in 1945 but never completed, was to be a flying boat, with the fuselage nacelle deepened to make a single-step hull, still keeping the back door above the waterline. Two retractable floats for stability in the water were mounted on outriggers on the sides of the hull. The wing, engines and tail from a standard land-based Aerovan would have been used in both cases.

One related development, a prototype of which flew briefly in 1947, was the Merchantman. This was a four-engined freighter midway in size between the Aerovan and the bigger Bristol Freighter.

Below: An idea of the excellent pilot visibility in the Miles Aerovan is given by this picture of a pre-delivery aircraft
Bottom: An Aerovan of East Anglian Flying Services based at Southend-on-Sea. The rear doors and high tail made for quick loading of freight or passengers





Aerovan

Type: light freight or passenger aircraft
Maker: Miles Aircraft Ltd
Span: 15.24 m (50 ft)
Length: 11 m (36 ft)
Height: 4.12 m (13 ft 6 in)
Wing area: 36.23 m^2 (390 sq ft)
Weight: maximum 2540 kg (5600 lb); empty 1393 kg (3070 lb)
Powerplant: two 150-hp Blackburn Cirrus Major III engines
Performance: maximum speed 193 km/h (120 mph) at 610 m (2000 ft); range 644 km (400 miles)
Payload: seats for 9 passengers
Crew: 1
Production: 48

Beaver, de Havilland Canada

FIRST FLIGHT 1947

BY the end of World War II, there was a requirement for a modern purpose-built utility transport to serve in backwood, undeveloped areas. For many of these regions the only means of communication is by air. This is particularly true in Canada's extreme north, an area demanding strong and reliable aircraft with good short-field performance and an alternative of floats or skis.

Following its success with the Chipmunk primary trainer, de Havilland Canada turned its attention to this requirement with the DHC-2 Beaver, designed as a seven-seat transport powered by a Pratt & Whitney 450-hp Wasp Junior. First flight took place in August 1947 with Canadian type certification coming seven months later. To obtain STOL (short take-off and landing) performance DHC chose slotted flaps which when lowered completely are complemented by slotted ailerons with a 15° droop. Large cabin doors are featured on each side of the fuselage, big enough to allow a standard 205-litre (45-Imp gal) drum to be loaded aboard.

The cabin floor is strong enough to support heavy freight loads and the cabin rear wall contains hatches which will permit the stowage of long cargo items. Optional undercarriages included floats, skis, or combined wheel/ski units, while an amphibian version featured floats with retractable wheels.

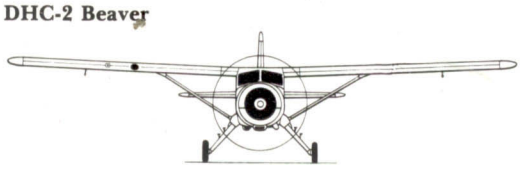
Like other types designed for the same utility role, the Beaver can be used as an air ambulance, crop-duster, aerial surveyor and paratroop transport. In 1953 one aircraft – the Beaver 2 – was fitted with a 550-hp Alvis Leonides radial engine and featured a taller fin and rudder.

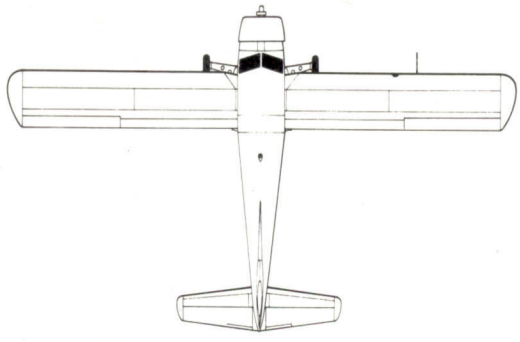
It was to be ten years though before a major change in Beaver development took place, with the advent of the Beaver 3. A longer cabin was produced by extending the fuselage to bring the cockpit further ahead of the wing, although the major change was the installation of a Pratt & Whitney PT6 turboprop powerplant. Initial deliveries of the Turbo-Beaver were in mid 1963.

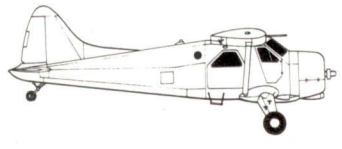
Turbo-Beavers can also be recognized by the swept fin and rudder of increased area. Nine passengers can be carried in the fuselage with a tenth one alongside the pilot. More than 1680 Beavers were built, over 1000 of these being supplied to military operators.

Top: One of three Beavers operated by Wilderness Airline of Williams Lake, British Columbia. Floats are essential, for two of the airline's depots are on lakes Above: The attractive lines of the Turbo Beaver with its larger rudder and swept fin. It is powered by a Pratt & Whitney PT6

DHC-2 Beaver







DHC-2 Turbo-Beaver

Type: utility light transport
Maker: de Havilland Canada Ltd
Span: 14.6 m (48 ft)
Length: 10.75 m (35 ft 3 in)
Height: 2.74 m (9 ft)
Wing area: 23.22 m² (250 sq ft)
Weight: maximum 2435 kg (5370 lb); empty 1360 kg (3000 lb)
Powerplant: one 578-ehp Pratt & Whitney PT6A-6 or PT6A-20 turboprop
Performance: maximum cruising speed 252 km/h (157 mph); range with maximum fuel and 45 min reserves 1090 km (677 miles)
Payload: seats for up to 10 passengers
Crew: 1
Production: approx 1690

Drover, de Havilland Australia

FIRST FLIGHT 1948

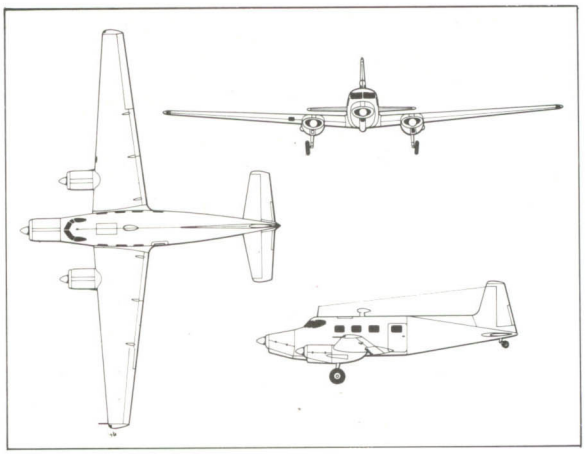
WHEN production of the venerable de Havilland Dragon biplane ended, the company's Australian subsidiary soon set to work designing a rugged replacement for the sort of arduous duties demanded by that country's outback. Durability and a safe performance after the loss of one engine were among the principal design aims, and the outcome was a three-engined aircraft. It was the first three-engined all-metal aircraft to fly in Australia.

Inevitably the design was in one sense a development of the Dove, but there was little resemblance in close detail, except around the cabin and in the fairly large windows. The Drover used three 145-hp Gipsy Major 10 Mk 11 engines (the same as that used in many marks of Chipmunk trainer) instead of the Dove's two larger Gipsy Queen 70s. Performance requirements, with one engine failed, were such that the designers had considered a four-engined aircraft, but they eventually settled on three engines. Three involved no weight penalty in the wing and little extra drag but could still produce a 50% power increase over a twin.

The prototype Drover first flew in January 1948, with chief test pilot Brian Walker at the controls, and he gave a good report of the handling and performance from the outset. Production got under way, with first deliveries being made the following year. Prospects for Drover sales initially looked good, but with the beginning of Vampire jet production, and a slow flow of Drover orders, only 20 were built. The Mk I was succeeded by a version with double-slotted flaps, the Mk II. Major operators in New Guinea or Australia were Qantas, Trans Australia Airlines, the Department of Health, Department of Civil Aviation, Fiji Airways, New Hebrides Airways and Air Melanesia. Best known operator was the Royal Flying Doctor Service, which flew them in Queensland and New South Wales. Seven of the latter's aircraft were re-engined with 180-hp Lycoming O-360-AIA engines to become Mk III Drovers, with Hartzell feathering propellers.

One of only two Drovers with British registrations is now preserved at Southend, Essex.

Seating arrangement allows for accommodation for up to eight passengers with a flight crew of either one or two. The ambulance version could carry two stretcher patients and two passengers.



DHA-3 Mk III

Type: light transport
Maker: de Havilland Aircraft Pty Ltd
Span: 17.37 m (57 ft)
Length: 11.12 m (36 ft 6 in)
Height: 3.28 m (10 ft 9 in)
Wing area: 30.2 m^2 (325 sq ft)
Weight: maximum 2948 kg (6500 lb); empty 2086 kg (4600 lb)
Powerplant: three 180-hp Lycoming O-360-A1A 4-cylinder horizontally opposed air-cooled engines
Performance: maximum speed 254 km/h (158 mph) at 2438 m (8000 ft); range 1448 km (900 miles)
Payload: seats for 8 passengers
Crew: 1
Production: 20

Left: A Mk III Drover of the Royal Flying Doctor Service of New South Wales, Australia. It is powered by three Lycoming O-360-A1A engines
Below: The Mk I and II Drovers had three 145-hp Gipsy Major 10 Mk II engines, the same powerplant used in many marks of the Chipmunk trainer

An-2, Antonov

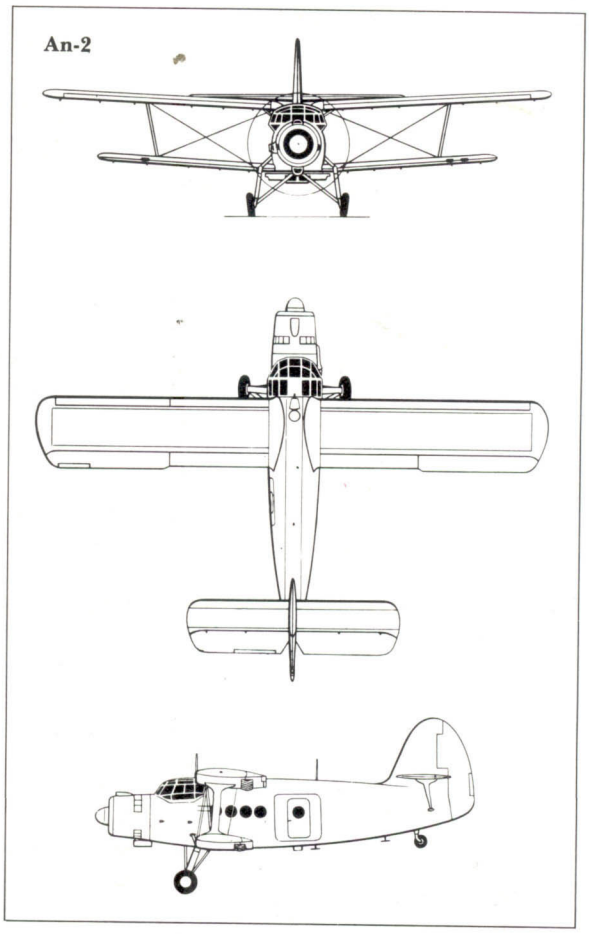
FIRST FLIGHT 1947

THE Antonov An-2 (codenamed Colt by Nato) is a classic example of an aerial-utility workhorse, with more than 12 000 produced in the Soviet Union and Poland since 1949. The type was originally designed to meet a Soviet agricultural and forestry ministry requirement. Powered by a Shvetsov ASh-21 engine of some 630 hp, the prototype flew in 1947.

Initially, the Colt was called the SKh.1 (from *Selskokhozyaistvennyi-1* – agricultural/economic). Production examples featured the 1000-hp ASh-62 radial engine and became known as the An-2. The biplane's reliability for all sorts of general-purpose work was soon apparent and operations as a passenger and freight transport were quickly extended to take in survey and photographic sorties, ambulance, parachute-training and rescue work. In Soviet air force service the type is used as a trainer for paratroops, radio-operators and navigators, and as a light freighter.

The basic version is the An-2P, accommodating up to 14 paratroops, or ten passengers, or six stretchers with attendants and four other seats. An agricultural version, the An-2S features an underfuselage pump to dispense crop-spraying chemicals via spray bars under the lower wing from a 1360-litre (300-Imp gal) tank. The An-2M, which entered service in 1965, provided an engine-driven system discharging powder or liquid from a larger 1950-litre (430-Imp gal) hopper. This version also included other changes: fin and rudder are noticeably more square-cut, the tailplane is larger and the aircraft can be flown by a single pilot.

In 1960 production began in Poland; the An-2P was a passenger version of the basic An-2T transport. A seaplane version of the P was developed as the An-2V with a reversible-pitch propeller. The An-2L water-bomber was derived from the V, having provision within the floats for water pick-up and evacuation. The An-2V is also known as the An-6, while the designation An-4 is applied by Antonov to the An-2ZA (a high-altitude meteorological research variant). This version, featuring an extra cockpit incorporated in the fin for ice observations, is powered by an ASh-62IR/TK with an external turbocharger to maintain 850 hp at altitudes of 10 000 m (32 800 ft). Licence-production of the An-2 has been carried out in China from 1957, and Poland and China remained the producers during the late 1970s.



Top: An Aeroflot An-2S painted yellow as a safety precaution during low-flying agricultural spraying operations
Above: A Hungarian An-2; the type is used in vast numbers in the Communist bloc for both civil and military applications

An-2P

Type: light utility transport
Maker: Antonov Design Bureau; WSK-PZL-Mielec
Span: 18.18 m (59 ft 8½ in)
Length: 12.74 m (41 ft 9½ in)
Height: 6.1 m (20 ft)
Wing area: 43.6 m² (469 sq ft)
Weight: maximum 5500 kg (12 125 lb); empty 3450 kg (7605 lb)
Powerplant: one 1000-hp Shvetsov ASZ-62IR 9-cylinder radial air-cooled engine
Performance: maximum speed 258 km/h (160 mph) at 1750 m (5740 ft); range at 1000 m (3280 ft) with 500 kg (1102 lb) payload 900 km (560 miles)
Payload: seats for up to 14 passengers
Crew: 2
Production: minimum 18 000 (of all models)

DHC-3 Otter, de Havilland Canada

FIRST FLIGHT 1951

FOLLOWING the success of the company's first two original designs, namely the Chipmunk primary trainer and the Beaver utility transport, aimed primarily at the Canadian backwoods, de Havilland Canada looked at the possibility of a larger but similar aircraft to do the same type of job in other outback regions of the world.

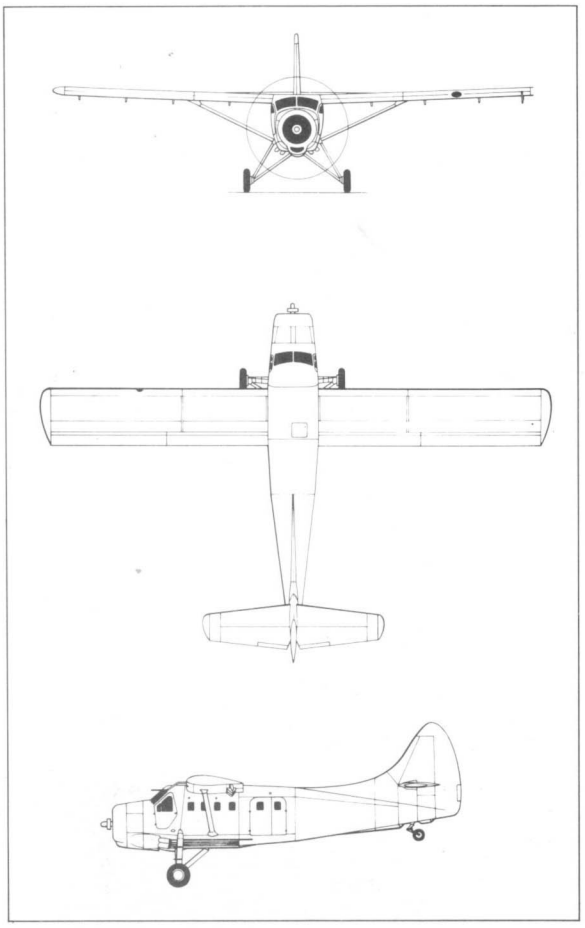
The King Beaver, as the design was initially called, was 3 m (10 ft) longer, had a 3-m (10-ft) wider span, and was 50% heavier, with a 50% bigger wing area and 50% greater maximum take-off weight. Ten or 11 passengers could be accommodated as opposed to the Beaver's seven, while power was supplied by a 600-hp Pratt & Whitney R-1430 Wasp. Canadian type certification came in late 1952, less than 12 months after the first flight, and the name Otter was chosen.

The cabin floor is stressed to carry cargo and a hatch in the floor can be used for freight or paratroop dropping, or as a camera port. As with other utility types, skis or floats may be fitted as an alternative undercarriage. There is an amphibious version with float/wheel combination units which feature hydraulic wheel retraction (into the floats). Up to six stretchers may be fitted in the cabin, leaving space for six attendants or 'walking wounded' in an aerial-ambulance layout. A higher maximum speed of 267 km/h (166 mph) and a lower empty weight of 1692 kg (3703 lb) are features of the turbine-powered version developed in Alberta in the mid 1970s by Cox Air Resources.

A more powerful version of the Pratt & Whitney PT6A turboprop engine used in de Havilland's own Turbo-Beaver is used in the Cox Turbo Single Otter (so named to avoid confusion with DHC's Twin Otter). Modification of the prototype was begun in 1976, at which time a market for as many as 75 units was estimated from a total Otter population of more than 200. The Turbo Otter can carry more fuel and a greater payload, with maximum range up from 1520 km (945 miles) to 1682 km (1045 miles).

Like its smaller predecessor the type soon proved to be attractive to the world's armed forces. It was used by the US Army and Navy as well as by Canada, Australia, India, Norway and many African and Far Eastern countries. Nine nations have operated Otters and Beavers in Antarctica. By 1971, 20 years after the first flight, almost 50 Otters remained in worldwide airline service.

Above: Aircrew walk out to their DHC-3 Otters assigned to the United Nations for liaison and observation in troubled areas
Left: An amphibian version of the Otter; though the floats create considerable drag they are very useful in the wilder areas of northern Canada



DHC-3

Type: light transport
Maker: de Havilland Canada Ltd
Span: 17.75 m (58 ft 10 in)
Length: 12.75 m (41 ft 10 in)
Height: 3.83 m (12 ft 7 in)
Wing area: 34.8 m^2 (375 sq ft)
Weight: maximum 3629 kg (8000 lb); empty 2010 kg (4431 lb)
Powerplant: one 600-hp Pratt & Whitney R-1340 S1H1-G Wasp 9-cylinder radial engine
Performance: maximum speed 257 km/h (160 mph); range 1410 km (875 miles)
Payload: seats for up to 11 passengers
Crew: 1
Production: minimum 400

Twin Beech, Beechcraft

FIRST FLIGHT 1937

THE Beech Model 18 had one of the longest production runs of any aircraft, lasting no less than 32 years from 1937. In that time more than 9000 were made, of which over 5200 were military versions delivered during World War II, while 2000 were civil aircraft produced after the war.

The first Model 18 was designed in 1936 as a passenger transport with accommodation for six people. The Beech 18 prototype made its maiden flight in January 1937, and aircraft produced prior to World War II were designated the 18, A18 and B18. The first military C-45 was delivered to the US Army Air Corps in the first half of 1940, and subsequent types included the C-45/UC-45 and TC-45J. The C-45G and H models were converted from T-7 and T-11 Kansan trainers, the RC-45H and TC-45H were photographic and training versions, while the RC-45H and TC-45J performed the same roles for the US Navy.

The navy's JRB-1, 2, 3 and 4 versions were utility transports, while the SNB-1 trainer was virtually the same as the T-11 Kansan, and the SNB-2 another version of the AT-7 navigator trainer. The AT-7/T-7 was derived from the commercial B-185S, and the AT-11/T-11 sported a lengthened glazed nose housing a bomb-aimer, plus a small bag for carrying weapons. A photographic survey version was designated the F-2.

Foreign air forces throughout the western world flew Model 18s after the war. They were used by the RAF and Royal Navy as the Expediter I and II. Some 30 foreign air forces were still flying the basic C-45 version in the mid 1960s.

After the war, civil versions included the C18 and D18. Of these, over 1000 were built. An improved E18 Super 18 was revealed in 1954. The E18 Super 18 had a much improved interior giving a greater degree of comfort to the passengers. The wings were modified structurally and more powerful powerplants fitted. Navigational equipment could be fitted to suit the customers' specialized requirements and two auxiliary rockets were optional. The G18 appeared late in 1959. The G18S had a slightly increased wing span and a reinforced structure. With uprated engines, the performance of this aircraft was a considerable improvement over the earlier variants. The last production version of all was the Super H18. The main features were new 'half fork' mainwheel legs, a refined exhaust system and lighter propellers. A high-density version of the Super H18, known as the Superliner, seats ten.

By the 1960s the Beech 18 was inevitably very old-fashioned in style and appearance. Its big radial engines and twin fins were very much of the 1930s, but the most dated characteristic was its tailwheel undercarriage. Thus a major modernization step was the nosewheel undercarriage, designed by Volpar and available as an option from 1963. Also available were a rocket-assisted take-off installation, and weather radar.

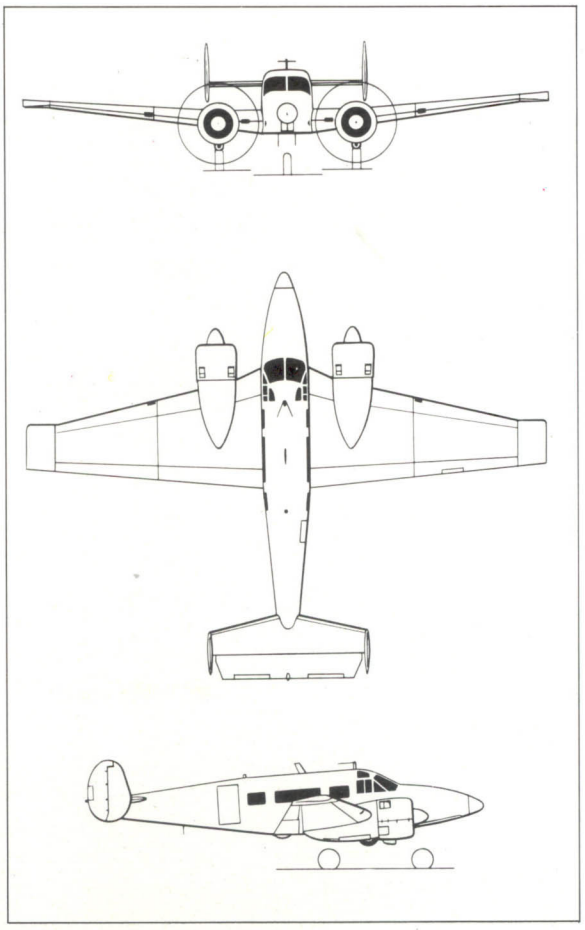
Several other modernized versions were also produced. These included the Dumod I, seating nine passengers, with a nosewheel undercarriage, modified wingtips for more speed, glassfibre control surfaces, and a larger flight-deck with bigger windows for the passengers. A longer version, the

Dumod Liner, was produced until 1970/71.

The Volpar/Beech 18 features a nosewheel undercarriage in which the mainwheels retract completely, and a lengthened nose. A turboprop development is known as the Volpar Super Turbo 18, with 575-shp Garrett-AiResearch TPE331-25 turboprop engines driving three-blade Hartzell reversible propellers. It also has a revised leading edge for the wing, which sweeps back at a greater angle to smaller wingtips.

Yet more versions include the Pacific Airmotive Tradewind with a nosewheel and single fin and rudder, the Turbo Tradewind with PT6A-6 turboprops, the Hamilton Westwind II and III with Pratt & Whitney PT6As, and the Rausch Star 250 with a high cabin roof.

Above: A Beech C-45H of the Californian commuter service of Air Cortez. This small operator flies from Ontario, east of Los Angeles, to towns in Mexico
Left: A Hamilton Westwind (Beech 18 conversion) of Connie Kalitta Services, a US third-level airline
Below left: A Twin Beech II at a US west coast airfield. The robust airframe has been stretched, re-engined and altered with new avionics, and remains in service as an air-taxi and commuter aircraft



Beech 18

Type: light transport
Maker: Beech Aircraft Corporation
Span: 14.5 m (47 ft 7 in)
Length: 10.08 m (33 ft 1 in)
Height: 2.79 m (9 ft 2 in)
Wing area: 33.54 m^2 (360.7 sq ft)
Weight: maximum 3979 kg (8750 lb); empty 2617 kg (5770 lb)
Powerplant: two 450-hp Pratt & Whitney R-985-B5 Wasp Junior radial air-cooled engines
Performance: maximum speed 370 km/h (230 mph) at 1525 m (5000 ft); range 1585 km (985 miles)
Payload: seats for up to 7 passengers
Crew: 1 to 2
Production: minimum 9000

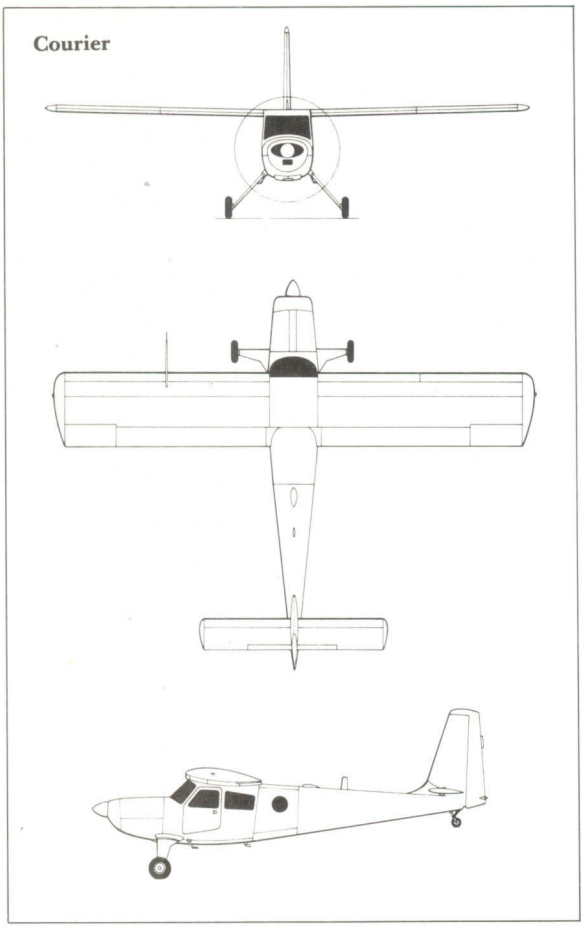
Courier, Helio

FIRST FLIGHT 1953

HELIO Aircraft Corporation was founded in 1948 by Dr Otto C Koppen and Dr Lynn Bollinger to develop and produce short take-off and landing aircraft which would offer helicopter-like performance. After experimenting with a much-modified Piper Vagabond lightplane fitted with full-span leading-edge slats, flaps and drooping ailerons, which they called the Helioplane (first flight April 8, 1949), they built the first Helio Courier in 1952. A four-seat high-wing STOL light/utility aircraft, the Courier entered production in 1954. It was powered by a 260-hp Lycoming engine and, because of its unusual aerodynamics, was able to fly in perfect safety and under full control at speeds below 48 km/h (30 mph). Six Couriers were built in 1954 and the aircraft was evaluated by the United States Army as a liaison aircraft and was given the military designation YL-24.

The first quantity production models were the Helio H-391 and H-395 Courier models introduced from 1958. In 1964 the 250-hp and 295-hp Lycoming-engined H-250 and H-295 Super Couriers appeared, the first H-295 flying on February 24, 1965. These models were widely ordered by the United States Government as U-10s for the USAF and for the CIA's (Central Intelligence Agency) clandestine airline Air America, which used them in South-East Asia during the Vietnam war for supply-dropping, spying, drug and gun-running and on psychological warfare missions. The Helio's ability to operate from tiny mountainside airstrips and to loiter at low altitude at ultra-low speeds made them favourite mounts for both USAF and Air America pilots. A tricycle-undercarriage version, the HT-295 Tri-Courier was introduced in 1974, and this aircraft remains in limited production.

Developments of the basic Courier design included the Helio H-500 Twin Courier, and the turboprop-powered HT-550A Stallion and Twin Stallion, all of which have now ceased production. More than 500 Couriers have been built and are widely used by bush fliers on wheels, skis and floats. A Super Courier used by a mountaineering expedition in Peru operated off 30-m (100-ft) long mountainside airstrips at an altitude of 4267 m (14 000 ft), aided by RATO (rocket-assisted take-off) tubes mounted on its fuselage sides, and an arrester hook for landing.



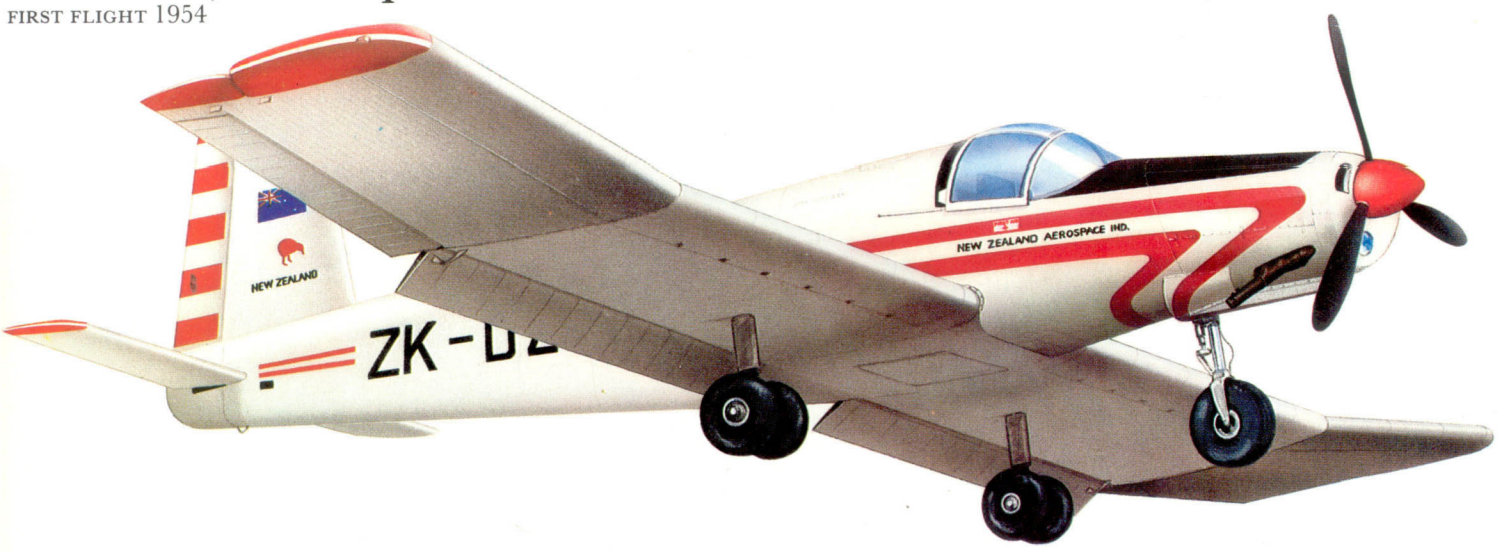
H-295 Super Courier

Type: STOL light utility transport
Maker: Helio Aircraft Co, Division of General Aircraft Corporation
Span: 11.89 m (39 ft)
Length: 9.45 m (31 ft)
Height: 2.69 m (8 ft 10 in)
Wing area: 21.46 m^2 (231 sq ft)
Weight: maximum 1542 kg (3400 lb); empty 943 kg (2080 lb)
Powerplant: one 295-hp Avco Lycoming GO-480-G1A6 flat-six piston engine
Performance: maximum speed 269 km/h (167 mph); range with full tanks 2027 km (1260 miles)
Payload: seats for 5 passengers
Crew: 1
Production: minimum 500 by 1980

Below: An Australian H-295 Super Courier at Point Cook, Victoria, powered by a 295-hp Lycoming flat-six engine
Bottom: A Helio Courier of Northward Aviation, a Canadian airline which links such remote communities as Aklavik, Pelly Bay, and Old Crow

Fletcher, Aerospace

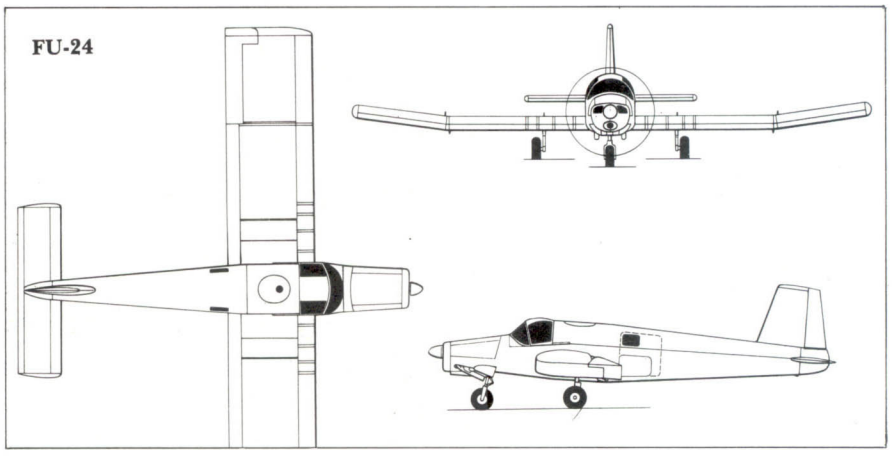
FIRST FLIGHT 1954



WENDELL Fletcher, an American industrialist, visited the South Pacific area in 1952 and solicited orders for a specialist agricultural aircraft which he then had designed in California by John Thorpe. The first Fletcher FU-24 Utility, manufactured by the Sargent-Fletcher company of El Monte, flew on June 14, 1954, powered by a 225-hp Continental O-470-E piston engine.

After 100 FU-24s had been supplied in component form to James Aviation Limited in New Zealand between 1954–1964, all manufacturing rights and production tooling were sold to Air Parts (NZ) Limited who continued to manufacture the basic single-seat version with a 300-hp Rolls-Royce Continental IO-520-F engine. This company, now known as New Zealand Aerospace Industries, has also developed a dual-control model of the FU-24, and the more powerful FU-24-950 which has a 400-hp Lycoming IO-720 engine and can carry a mechanic/loader in a ferry seat for top-dressing operations or, in utility form, up to seven passengers.

The FU-24 is unusual among agricultural aircraft in having a tricycle undercarriage, but New Zealand operators have found the rugged nosewheel landing gear well-suited to that country's steep, twisting landing strips. The cockpit area is stressed to withstand a 25-g impact – much more than the human body can tolerate – and is protected by a steel truss. New Zealand Aerospace Industries claim the lowest fatality rate for any agricultural aircraft with the FU-24. By mid 1978 production of the aircraft totalled 256, with customers in Australia, Bangladesh, Iraq, New Zealand, Pakistan, Thailand and Uruguay.



In 1978 New Zealand Aerospace Industries developed a turboprop model of the FU-24 known as the FU-1284 Cresco which is powered by a 600-shp Avco Lycoming LTP-101 turboprop and has an additional fuselage section providing an extra 1.33 m^3 (47 cu ft) of hopper space aft of the cabin, the additional payload being compensated in the lighter weight of the turbine powerplant. Current versions powered by Pratt & Whitney of Canada PT6A and Garrett-AiResearch TPE331 turboprops are also flying in the agricultural or passenger utility role. The agricultural version can be equipped with a variety of top-dressing, seeding and low- and high-volume spraying equipment.

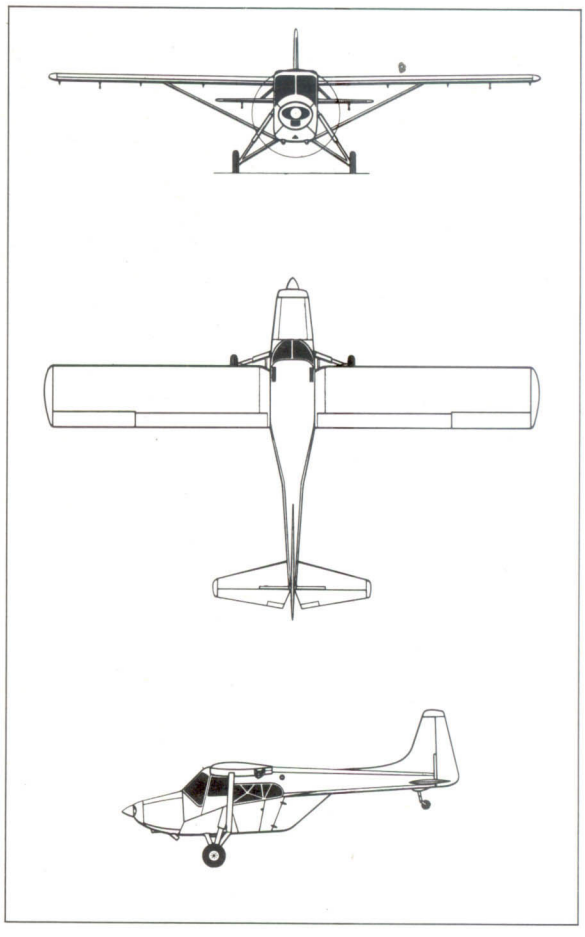
FU-24-950

Type: agricultural and utility aircraft
Maker: New Zealand Aerospace Industries Ltd
Span: 12.81 m (42 ft)
Length: 9.7 m (31 ft 10 in)
Height: 2.84 m (9 ft 4 in)
Wing area: 27.3 m^2 (294 sq ft)
Weight: maximum 2204 kg (4860 lb); empty 1188 kg (2620 lb)
Powerplant: one 400-hp Avco Lycoming IO-720-A1A piston engine
Performance: maximum cruising speed 196 km/h (122 mph); range 709 km (441 miles)
Payload: 1052 kg (2320 lb); up to 7 passengers may be carried in utility form; variety of spraying equipment, capacity 1045 litres (230 Imp gal) or 1.05 m^3 (37 cu ft) dry chemicals
Crew: 1
Production: 310 ordered by January 1979

Top: An FU-24 in the colours of New Zealand Aerospace Industries
Left: An FU-24 of Robertson Air Service, New Zealand

E.P.9, Edgar Percival

FIRST FLIGHT 1955



EDGAR Percival who became well-known in the late 1930s for his Percival Gull series of light aircraft, re-entered the British aircraft industry with the E.P.9 in the mid 1950s. It was based on ideas he evolved during a tour of New Zealand and Australia, and was designed for a variety of uses, such as crop-spraying, or stretcher carrying.

The unusual pod-and-boom configuration allowed a very deep front fuselage which could carry 1016 kg (2240 lb) of fertilizer in a hopper discharging through the floor. Pilot and passenger sat high in the front with a good view for low-level flying. Behind them could be carried four passengers, or three stretcher cases with an attendant, or a variety of rural loads. The side and rear clamshell doors were large enough to take bales of straw or wool, 205-litre (45-Imp gal) oil drums and livestock.

The first flight was made in 1955 and by late 1956 20 aircraft had been produced. Several were sold overseas, and two went to the British Army Air Corps.

The E.P.9 proved to be very versatile in service. One was delivered to Germany and fitted out for spraying fruit crops. Insecticide from the 773-litre (170-Imp gal) tank was distributed through holes in underwing booms to spray a swathe 27 m (90 ft) wide at 161 km/h (100 mph). Other aircraft went to Australia, the Bahamas, Libya, New Zealand and Canada, where one was operated on floats.

In 1958 Edgar Percival sold his major shareholding in his company to Samlesbury Engineering, together with his rights to the design for the United States, Canada and Mexico. Over 20 partially complete aircraft were moved to Squires Gate at Blackpool where the new company, Lancashire Aircraft, completed two aircraft with slightly larger Lycoming engines and three-bladed propellers under the new designation Lancashire Prospector E.P.9.

In 1960 production was moved to Samlesbury. One of the aircraft completed here was fitted with a 375-hp Armstrong Siddeley Cheetah 10 radial, and was one of only two so converted.

The two army E.P.9s became surplus to military requirements and left the Army Air Corps centre at Middle Wallop for civilian homes in 1961. One E.P.9 was fitted out as a six-seater and used as a communications and joyriding aircraft by Skyways until 1968.

E.P.9

Type: light freight or passenger aircraft
Maker: Edgar Percival Aircraft Ltd
Span: 13.25 m (43 ft 6 in)
Length: 8.99 m (29 ft 6 in)
Height: 2.67 m (8 ft 9 in)
Wing area: 21.1 m^2 (227.6 sq ft)
Weight: maximum 1610 kg (3550 lb); empty 912 kg (2010 lb)
Powerplant: one 270-hp Lycoming GO-480-B1B flat-six engine
Performance: maximum speed 235 km/h (146 mph) at 2440 m (8000 ft); range 933 km (580 miles)
Payload: seats for 5 passengers
Crew: 1
Production: 24

Top left: G-AOFU, the first E.P.9 to be built, was exported to Africa, where it crashed while crop-spraying at Maturabi, Sudan, in November 1962
Above left: A French-registered E.P.9 of Fenwick Aviation. The type is also popular for sport parachuting

Ag-Cat, Gulfstream American

FIRST FLIGHT 1957

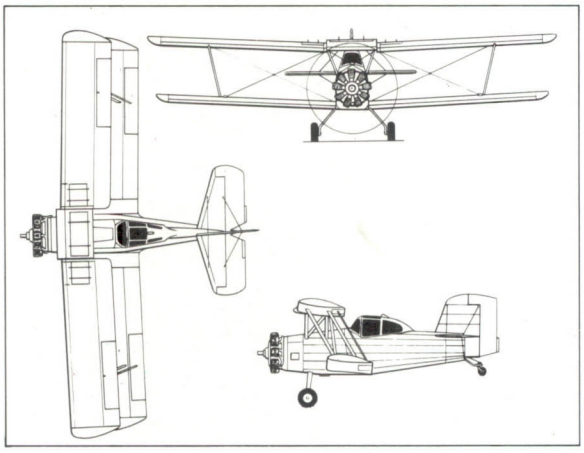
THE first Ag-Cat G-164 agricultural aircraft flew on May 22, 1957. Designed as a rugged, all-metal machine with biplane configuration to provide the low wing-loading necessary for lifting heavy payloads at low airspeeds, the aircraft was produced for the Grumman company by the Schweizer Aircraft Corporation of Elmira, New York. The first Ag-Cats were powered by 225-hp Continental W-670 radial engines. Versions with 240-hp Gulf Coast W-670 and 300-hp Jacobs R-755 engines were offered in later years, and the Super Ag-Cat G-164B was certificated in 1966 with a choice of three engines: 300-hp Jacobs; 450-hp Pratt & Whitney R-985; or 600-hp Pratt & Whitney R-1340.

The current production model Super Ag-Cat G-164C features a wing of increased span (12.88 m [42 ft 3 in] instead of 10.95 m [35 ft 11 in] on earlier models) and has a gross weight some 1100 kg (2425 lb) higher than the G-164B. The G-164C is powered by a 600-hp Pratt & Whitney R-1340 radial engine.

The Ag-Cat C airframe also forms the basis for the G-164D Turbo Ag-Cat D, which was developed with a Pratt & Whitney of Canada PT6A turboprop engine and is in current production alongside the piston-engined model.

Other Ag-Cats are flying experimentally with 600-shp Lycoming LTP-101 and Garrett-AiResearch TPE331 turboprops and a 650-hp liquid-cooled Chrysler automobile engine converted for aircraft use. Mid-Continent Maintenance Division of Hayti, Missouri has also re-engineered the Ag-Cat to take a massive 1200-hp Wright Cyclone R-1820 radial engine. This aircraft, appropriately called King Cat, can operate at a gross weight of 4309 kg (9500 lb) and take off in just 300 m (984 ft). One Ag-Cat underwent conversion by Serv-Aero Engineering. This involved the fitting of a 560-hp Alvis Leonides radial engine.

The Ag-Cat has been exported to more than 40 countries. Two thousand are in operation worldwide and in the first six years of agricultural operation in the United States Ag-Cats logged more than 1 million flying hours without a fatal accident. In May 1980 manufacture of the aircraft was transferred from Schweizer to the parent Gulfstream American factory at Savannah, Georgia.



Ag-Cat G-164C

Type: agricultural biplane
Maker: Schweizer Aircraft Corporation for Gulfstream American Aircraft Corporation
Span: 12.88 m (42 ft 3 in)
Length: 9.14 m (30 ft)
Height: 3.48 m (11 ft 5 in)
Wing area: 36.42 m^2 (392 sq ft)
Weight: maximum 3855 kg (8500 lb); empty 1696 kg (3740 lb)
Powerplant: one 600-hp Pratt & Whitney R-1340 radial piston engine
Performance: maximum speed 237 km/h (147 mph); range 650 km (404 miles)
Crew: 1
Production: 2280 by January 1979

Top: An Ag-Cat G-164 agricultural aircraft
Above left: Ag-Cat N-4859. The black (or blue) and yellow colour scheme is common for low-flying agricultural aircraft in the USSR and the West
Above: A G-164D Turbo Ag-Cat powered by a Pratt & Whitney PT-6A

JetStar, Lockheed

FIRST FLIGHT 1957

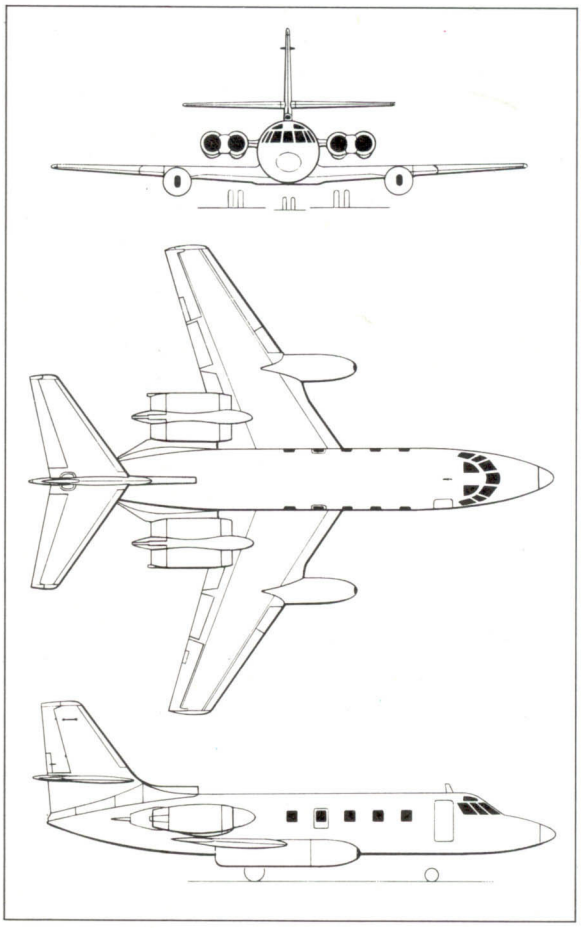
Left: A Lockheed JetStar of the Canadian Department of Transportation, photographed in October 1968
Below left: A JetStar comes in to land; fuel is stored in the large non-removable wing tanks. In the Mk II version these tanks are underslung ahead of the wing

THE Lockheed Model 1329 JetStar was conceived in 1956 and announced in March of the following year, flying in prototype form as a private venture six months later, fewer than 250 days after design work began. The jet-powered utility transport was offered for operation by a crew of two with accommodation for eight to ten passengers. Initially the aircraft was powered by two British Bristol Siddeley Orpheus turbojets but one prototype was re-engined in late 1959 with Pratt & Whitney JT12 turbojets, which were adopted for production aircraft.

Following soon after the Rockwell Sabreliner, the JetStar is unique among the family of light jet-transport aircraft in having an all-moving tailplane for longitudinal control, and in being powered by four engines. Construction is of conventional aluminium-alloy stressed-skin semi-monocoque fail-safe structure. Plain ailerons are mechanically operated with hydraulic boost, while aileron tabs are electro-mechanical. There are no spoilers fitted to the wing, which features hinged leading-edge flaps and double-slotted trailing-edge flaps. Rare among civil jet transports is the hydraulic speed-brake fitted beneath the rear fuselage; rudder and elevators are mechanically operated. Internal fuel capacity is increased by the use of two non-removable external tanks fitted on the wings. The normal cabin-layout features wardrobe, galley and lavatory, although this can be varied to suit individual requirements.

Two versions of the JetStar – C-140A and the VC-140B – were developed for the United States Air Force and by 1973 more than 150 had been delivered throughout the world for business and corporate use, no more orders being accepted after that year, pending a new longer-range version. A modification kit developed by AiResearch Aviation utilizing the Garrett TFE731-3 turbofan (which offered the traditional fan advantages of greater fuel economy combined with less noise) was adopted by Lockheed in its JetStar II, incorporating many other changes.

Perhaps the most obvious visible change is the redesign of the external fuel tanks, which are now underslung ahead of the wing. Lockheed claims that this new shape results in reduced drag, another advantage being that the aircraft centre of gravity is more flexible and fuel-flow management is more easily controlled.



JetStar II

Type: light utility and business jet transport
Maker: Lockheed Aircraft Corporation
Span: 16.6 m (54 ft 5 in)
Length: 18.42 m (60 ft 5 in)
Height: 6.23 m (20 ft 5 in)
Wing area: 50.4 m^2 (542½ sq ft)
Weight: maximum 20 185 kg (44 500 lb); empty 10 700 kg (23 578 lb)
Powerplant: four 1678-kg (3700-lb) st Garrett-AiResearch TFE731-3 turbofans
Performance: maximum speed 880 km/h (547 mph) at 9145 m (30 000 ft); range with maximum payload and 30 min reserves 4818 km (2994 miles)
Payload: 1247 kg (2750 lb); seats for 10 passengers
Crew: 2
Production: I (141), II (40)

Sabreliner, Rockwell

FIRST FLIGHT 1958

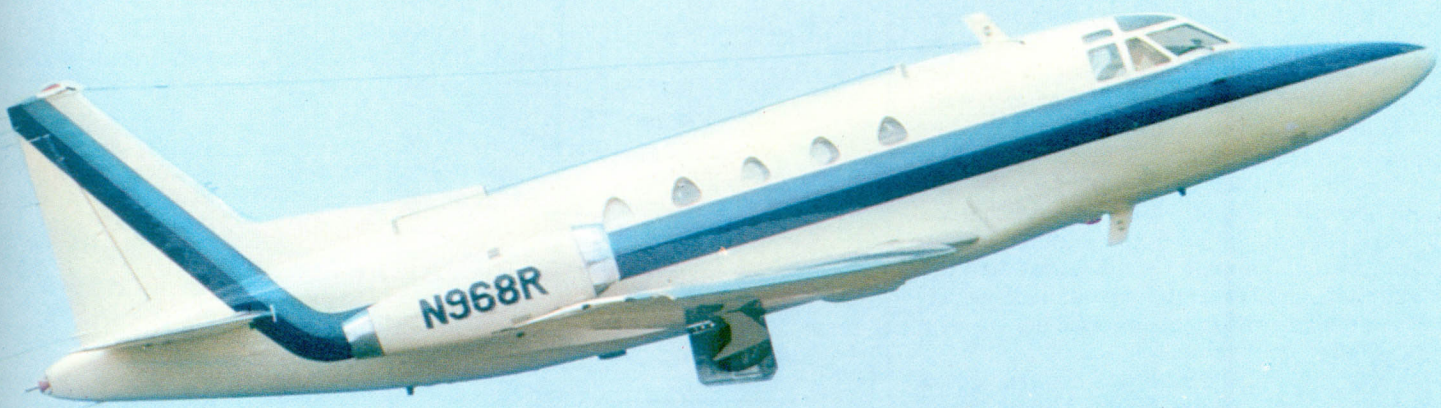
THE North American (now Rockwell International) Sabreliner was one of the first business jets on the market. It was, however, developed originally to meet a United States Air Force specification for a combat-readiness trainer and utility aircraft, and it serves with the USAF and Navy as the T-39. The prototype flew for the first time on September 16, 1958, powered by two General Electric J85 turbojet engines. The first commercial version, designated Sabreliner 40 and powered by 1360-kg (3000-lb) thrust Pratt & Whitney JT12A-6A engines, was introduced in 1962. It seated up to seven passengers with a two-man crew; the first customer delivery was made in May 1963, and in all some 125 Sabre 40s were manufactured.

A lengthened Sabreliner 60 seating nine passengers was introduced in 1967 powered by 1497-kg (3200-lb) JT12A-8 engines. In 1970 the Sabreliner 70 with the same engines, but a deeper fuselage offering stand-up headroom was introduced, later to be redesignated Sabreliner 75. This model was fitted with fuel-efficient General Electric CF700-2D turbofan engines as the Sabreliner 75A in 1973, and continues in production.

The Raisbeck Group of Seattle, Washington have developed a new supercritical wing offering increased fuel load and overall performance improvements for the Sabreliner. This wing is available as a retrofit to Sabreliner 60s as the Mk 5 conversion, and has been adopted by the parent company Rockwell International for the latest Sabre 65, which first flew on June 29, 1977, followed on September 8, 1978 by the first Raisbeck-modified Sabre Mk 5 60A. The Sabre 65 is powered by two 1678-kg (3700-lb) thrust Garrett-AiResearch TFE731-3 turbofans. Its cabin can be configured for four to ten passengers, and it has a cruising speed of 849 km/h (528 mph) with a maximum range with IFR reserves of 4595 km (2855 miles). In June 1979 the first production Sabreliner 65 made the longest flight of any Sabreliner in history when it flew from St Louis to Le Bourget Airport for the Paris Air Show. By December 1979, Rockwell held 70 orders for the latest model Sabreliner.

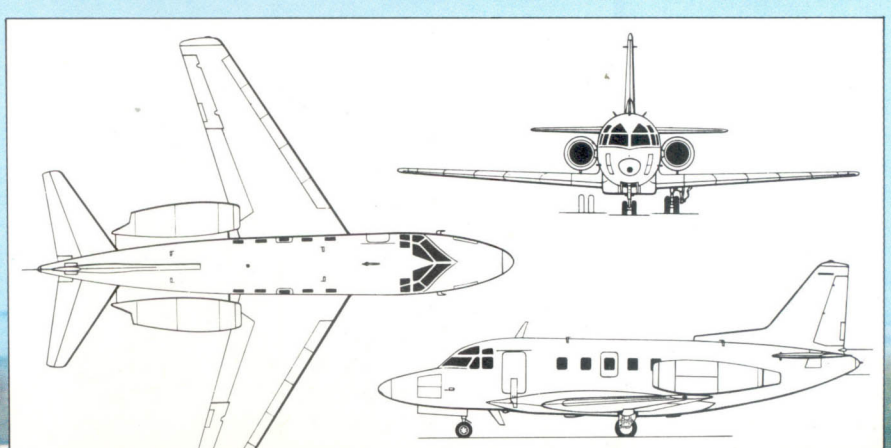
A proposed supercritical-winged model of the Sabreliner 75A has been abandoned by Rockwell, but the Raisbeck Corporation are offering Mk 5 wing retrofits to existing Model 75A operators. The modified aircraft is designated Sabreliner 80A.

Above: The Saberliner 60 was generally similar to the Series 40 and had accommodation for up to ten passengers
Below: A Series 60 takes off from a suburban airport in the USA



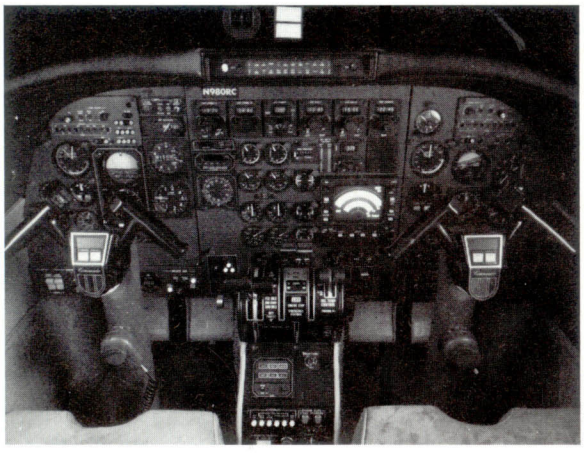
Sabreliner 75A

Type: business and corporate transport
Maker: Rockwell International Corporation
Span: 13.61 m (44 ft 8 in)
Length: 14.38 m (47 ft 2 in)
Height: 5.26 m (17 ft 3 in)
Wing area: 31.8 m^2 (342 sq ft)
Weight: maximum 10 432 kg (23 000 lb); empty 5987 kg (13 200 lb)
Powerplant: two 2041-kg (4500-lb) st General Electric CF700-2D-2 turbofans
Performance: maximum cruising speed 906 km/h (563 mph); range 3149 km (1957 miles) with 4 passengers and IFR reserves
Payload: seats for 10 passengers
Crew: 2
Production: 610 (all types) by 1980



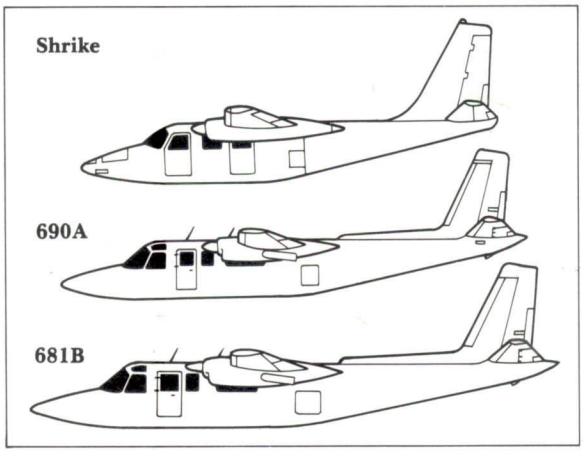
Turbo Commander, Rockwell

FIRST FLIGHT 1964



THE lineage of the Rockwell Turbo Commander can be traced back 30 years to the Aero Commander Model 520 light twin-engine business aircraft. It was designed by ex-Douglas Aircraft project engineer Ted Smith and went into production at Bethany, Oklahoma in 1951. A succession of piston-engined models followed, including the Model 560 (260-hp Lycoming GO-480 engines), Model 680 Super (340-hp supercharged Lycomings), Model 500 (260-hp Continental IO-470-M or 250-hp Lycoming O-540-A2Bs), and the Model 720 Alti Cruiser introduced in 1959 which was the first light business aircraft to have a pressurized passenger cabin.

In the early 1960s the line was refined and a stretched Aero Commander 680FL Grand Commander introduced. It was the airframe of a pressurized 680FLP Grand Commander which formed the basis of the first Model 680T Turbo Commander which first flew from Bethany on December 31, 1964. Apart from its Garrett-AiResearch turboprop engines the Turbo Commander was externally similar to its piston-powered stablemate. Production deliveries commenced in April 1965 and after Aero Commander merged with North American Rockwell, the improved Models 680V (increased gross weight) and 680W (lengthened nose, uprated engines) Turbo Commanders were introduced, followed by a further refined Model 681 Hawk Commander. The original name Turbo Commander was restored when the Model 681B, featuring 605-shp Garrett-AiResearch turboprops and with accommodation for up to nine passengers, was marketed in 1971.

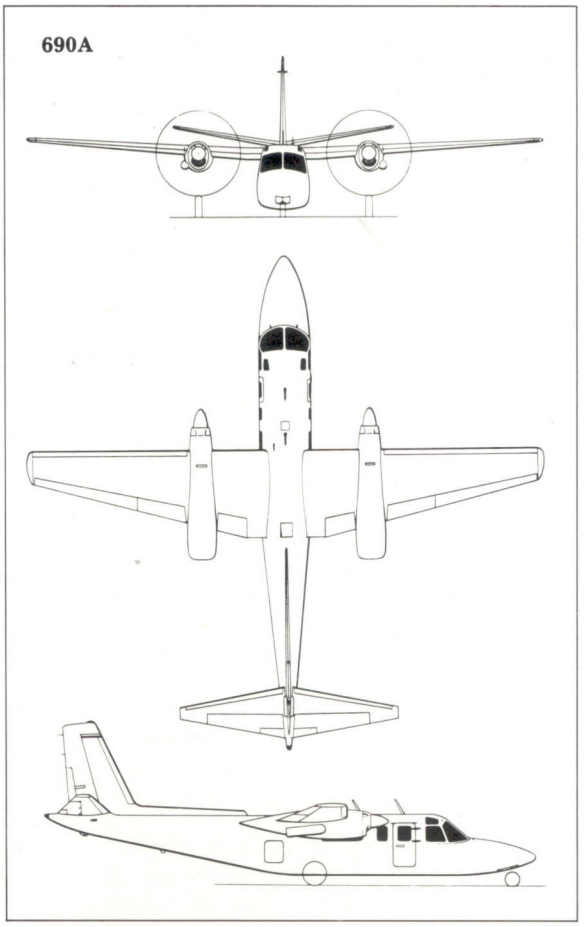


The 1977 Turbo Commander 690B established seven world records for its class, including five which were set publically during the 1978 Hanover Air Show when Rockwell's famous test and demonstration pilot Bob Hoover climbed a 690B to 3000 m (9842 ft) in 2 min 21 sec from take-off brake release, to 6000 m (19 685 ft) in 5 min 11 sec, and to 9000 m (29 527 ft) in 9 min 23 sec. German Commander dealer Jo Blumschein flew the same aircraft to a zoom altitude record of 12 725 m (41 750 ft) and a sustained altitude of 12 444 m (40 830 ft). In 1979 the Turbo Commander 690B was offered in a specially commissioned grey pinstripe colour scheme to appeal to the business-executive market.

Top left: The Jetprop Commander 840 (top) and the 980 (bottom) in flight in August 1979. Both aircraft have wingletted wings which give improved performance
Above left: The flight-deck of the Commander 980; it has been designed for easy maintenance with an emphasis on crew comfort
Left: Side elevations showing the variants of the Commander series
Above: A West German Turbo Commander; it was a great success at the Hanover Air Show in 1978 where it set up five world records for its class

Sales of all Hawk/Turbo Commanders had been less than satisfactory when another model, the Turbo Commander 690 (first flown on March 3, 1969) was certificated by the US Federal Aviation Administration in July 1971. This model had longer wings, engines uprated to 700 shp each, higher gross weight and many performance improvements. It was followed a year later by the further improved Turbo Commander 690A which had increased cabin pressure differential and still better performance, offering a cruising speed of 465 to 518 km/h (289 to 322 mph) and a range of 2223 km (1381 miles) at high-speed cruise. The 690A's Garrett-AiResearch TPE331-5-251 turboprop engines were flat-rated to 725 shp each.

At the US National Business Aircraft Association Convention held in October, 1979 at Atlanta, Georgia, Rockwell announced two new Turbo Commander models for the 1980s which will replace the 690B – the Jetprop Commanders 840 and 980. Both aircraft feature new high-efficiency wingletted wings which the manufacturers claim contribute an additional 7.5 km/h (4.6 mph) in cruise speed and improve climb performance by up to 11%. The two Jetprop Commanders are externally similar except for their 840-shp and 980-shp Garrett-AiResearch TPE331 engines, which drive lightweight supercritical propellers developed by Dowty-Rotol in England. The Jetprop 840 cruises at 547 km/h (340 mph) while the more powerful 980 cruises at 583 km/h (362 mph). Deliveries of the 840 began in October 1979 and the 980 in January 1980. Two more Turbo Commander derivatives are under development.



Turbo Commander 690B

Type: business and corporate transport
Maker: Rockwell International General Aviation Division
Span: 14.22 m (46 ft 8 in)
Length: 13.52 m (44 ft 4 in)
Height: 4.56 m (14 ft 11½ in)
Wing area: 24.7 m^2 (266 sq ft)
Weight: maximum 4683 kg (10 325 lb); empty 2810 kg (6195 lb)
Powerplant: two 700-shp Garrett-AiResearch TPE331-5-251K turboprops
Performance: maximum cruising speed 526 km/h (327 mph); range (full fuel) 2379 km (1478 miles)
Payload: seats for 6 passengers
Crew: 2
Production: 280 (all types)

BAe 125, British Aerospace

FIRST FLIGHT 1962

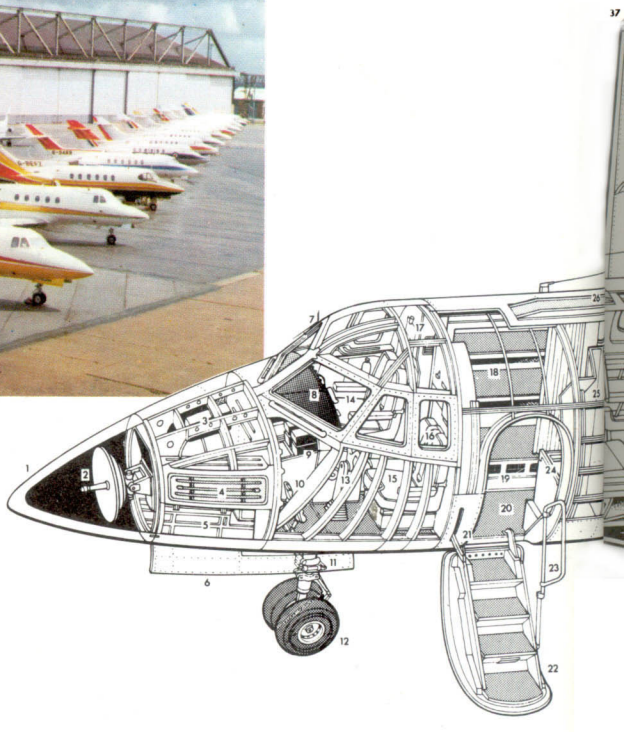
THE BAe 125 is one of the most successful of all European business jets. It dates back to a design originally known as the Jet Dragon. This was a 6- to 8-passenger aircraft designated the DH.125, for two crew and powered by two 1360-kg (3000-lb) Bristol Siddeley Viper 20 turbojets. A production batch of 30 aircraft was planned for the Chester factory and two prototypes were built at Hatfield. Design had begun in 1961 and a prototype first flew in July 1962, followed by the maiden flight of the other in December. The first production aircraft was fitted with Viper 520 engines, which were to power the first batch of production aircraft. The first two customer deliveries went to Germany and Switzerland.

Nine Series 1 production aircraft were built, after which the cabin windows were decreased from six to five. A change of engines to Viper 521s and 522s was also made, thus enabling an increase of gross weight to 9525 kg (21 000 lb). As with subsequent aircraft, the Series 1A denoted aircraft for the American market, and 1B aircraft for the rest of the world.

The first American delivery was made in late 1964. By then, de Havilland had been absorbed into the Hawker Siddeley group, but in the United States it was decided to continue selling the aircraft as the DH.125 and not HS.125.

It was sold in Britain and Europe as the HS.125, as well as attracting custom as a VIP transport from foreign air forces. One British-registered aircraft was in fact hijacked while carrying a

Left: A BAe 125 in manufacturer's livery during a test flight
Below left: A line-up of BAe 125s await delivery. They are painted in customer colours which include the RAF and JCB (JC Barford, civil engineers). Optional extras include an interior leather trim, stereo cassette player, slide-out bar and luxury lavatory



BAe 125-700

1 Radome
2 Radar scanner
3 Nose equipment bay
4 VOR localizer aerial
5 Nose undercarriage bay
6 Nosewheel doors
7 Windscreen
8 Instrument panel shroud
9 Back of instrument panel
10 Rudder pedals
11 Nosewheel steering jack
12 Twin nosewheels
13 Control column
14 Second pilot's seat
15 First pilot's seat
16 Safety harness
17 Electrical distribution panel
18 Baggage compartment
19 Avionics racks
20 Vestibule
21 External doorhandle
22 Entry steps
23 Handrail
24 Galley
25 Galley storage locker
26 ADF aerial
27 HF aerial
28 Wardrobe
29 Fuselage stringer construction
30 Rearward facing passenger seats
31 Cabin windows
32 Folding table
33 Emergency exit window
34 Fuselage main frame
35 Right wing fuel tank
36 Wing fence
37 Right navigation light
38 Static dischargers
39 Right aileron
40 Trim tab
41 Geared tab
42 Aileron fence
43 Airbrake
44 Right flap
45 Window blind
46 Rear cabin seats
47 Ram air intake
48 Passenger service unit
49 Cabin window panel
50 Three-seat settee
51 Magazine rack
52 Right engine cowling
53 Intake duct to heat exchangers
54 Water tank
55 Air-conditioning supply
56 Wash basin
57 Toilet compartment
58 Pressure bulkhead frame
59 Dorsal fuel tank
60 Heat exchanger
61 Air-conditioning plant
62 Auxiliary power unit
63 APU intake
64 Rear equipment compartment
65 Fin spar attachment
66 Fin root fairing
67 Fin construction
68 Control cable ducting
69 Aerial attachment
70 Right tailplane
71 Right elevator
72 Static dischargers
73 Elevator tab
74 Overfin
75 Anti-collision light
76 VHF aerial
77 Fin bullet fairing
78 Tail navigation light
79 Left elevator
80 Tailplane construction
81 Leading-edge de-icing
82 Elevator hinge control
83 Rudder construction
84 Rudder tab
85 Tailcone
86 Ventral fin
87 Rudder hinge control
88 Oxygen bottles
89 Batteries
90 Engine pylon fairing
91 Fire extinguisher
92 Garrett-AiResearch TFE731 turbofan
93 Detachable cowling
94 Engine intake
95 Ventral fuel tank
96 Main undercarriage well
97 Flap hinge control
98 Undercarriage leg pivot fixing
99 Flap screwjack
100 Double-slotted flap construction
101 Airbrake jack
102 Left airbrake
103 Aileron fence
104 Aileron hinge control
105 Geared tab
106 Trim tab
107 Aileron construction
108 Static dischargers
109 Aileron horn balance
110 Fuel filler cap
111 Integral wing fuel tank
112 Wing fence
113 Leading-edge construction
114 Main undercarriage leg
115 Twin mainwheels
116 Landing and taxi lamp
117 Wing construction
118 Leading-edge de-icing
119 Rear spar attachment links
120 Centre wing box construction
121 Front spar attachment links
122 Ventral strake
123 Wing root fillet

former Congolese prime minister, and was impounded in Algeria for almost a year.

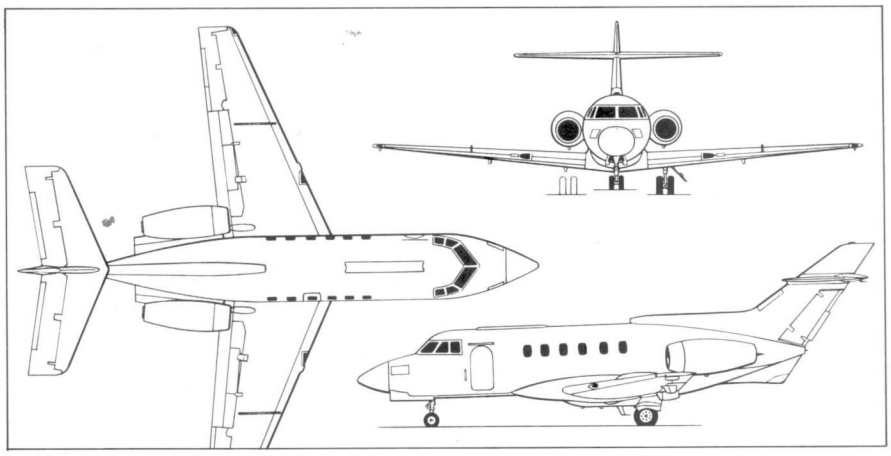
An order for 20 was placed by the RAF in 1963. Designated Series 2, these became known as the Dominie T Mk 1 and serve as navigation trainers and VIP transports. Series III crew trainers, with Boeing 707-style cockpit layouts, were built for Qantas. Series IIIA and IIIB versions had Viper 522 engines. Improvements followed to give an increase in take-off weight, allowing additional fuel capacity in a large tank faired to the fuselage underside, and a ventral fin had to be added. From mid 1967 all HS.125s were built to this standard, as the Series IIIA-RA and IIIB-RA. The Series 400 followed, with seven luxury seats, an integral airstair door, new flight-deck and further weight increase to 10 570 kg (23 300 lb).

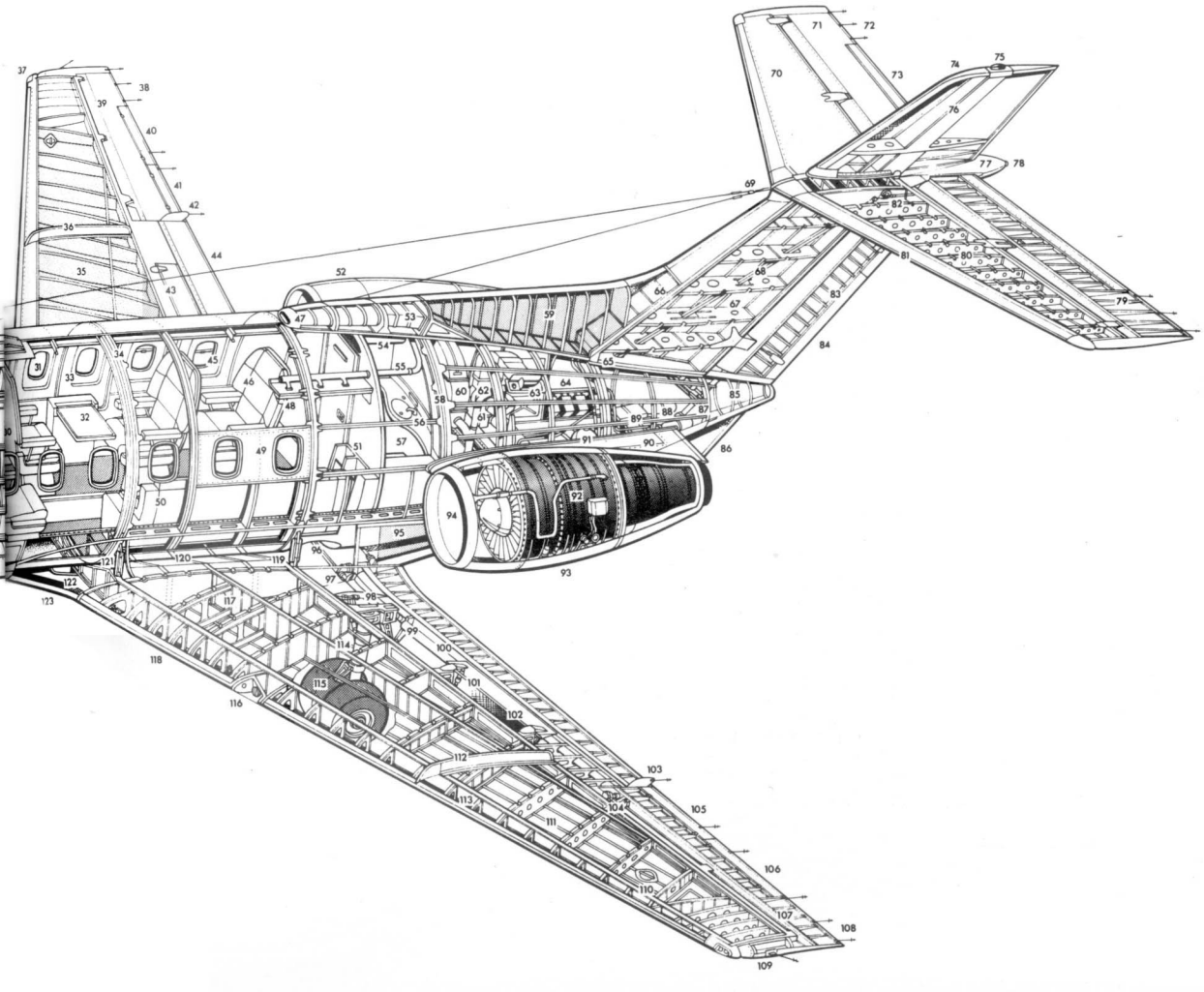
In 1969 HS.125 marketing in the US was transferred to Beechcraft, the aircraft was termed the BH-125 and the Beechcraft Hawker Aircraft Corporation was created. By early 1972 over 270 125 aircraft of all kinds had been built, most of them being exported. The Series 600 was faster and larger with more powerful Viper 600 turbojets, but even more performance was produced by the Series 700, introduced in 1976. This was fitted with Garrett-AiResearch TFE731-3-1H turbofan engines of better specific fuel consumption than the earlier Viper turbojets, which met all international noise requirements. The prototype was produced from a Series 600 airframe, first flying June 1976.

Airframe improvements in Series 700 aircraft for less drag and more attractive appearance include a re-shaped wing keel skid, use of countersunk, instead of mushroom-headed, rivets in the inner tank doors, aileron trailing edges and flap-botton skins, a new ventral fin and fairings, and countersunk rivets for the fuselage and tail.

There were also interior refinements such as leather trim, stereo cassette player, luxury lavatory, slide-out bar box and a range of new interior colour schemes.

The first Series 700 aircraft flew in November 1976 and was certificated a year later. By late 1979 over 100 Series 700s had been sold, including 60 for the US. The Irish Air Corps was just one of several military customers. From 1978 the designation has been BAe 125, reflecting the manufacturer's absorption in British Aerospace.





BAe 125 Series 700

Type: executive transport
Maker: British Aerospace
Span: 14.33 m (47 ft)
Length: 15.46 m (50 ft 8½ in)
Height: 5.36 m (17 ft 7 in)
Wing area: 32.8 m² (353 sq ft)
Weight: maximum 11 249 kg (24 800 lb); empty 5826 kg (12 845 lb)
Powerplant: two 1678-kg (3700-lb) st Garrett-AiResearch TFE 731-3-1H turbofans
Performance: maximum cruising speed 808 km/h (502 mph) at 8380 m (27 500 ft); range 4318 km (2683 miles)
Payload: seats for 8 passengers
Crew: 2
Production: 480 (of all models)

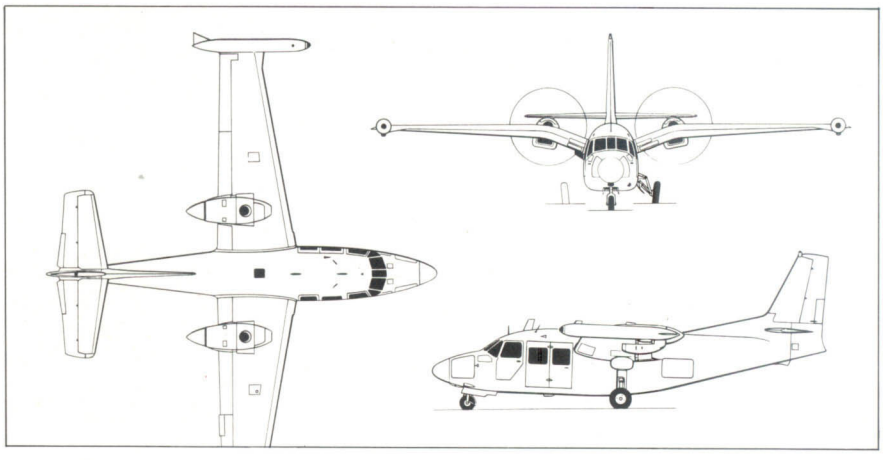
P.166, Piaggio

FIRST FLIGHT 1957

THE history of this Italian executive light-transport aircraft, which is still in production today, can be traced back almost to World War II. The type is based upon and carries some of the design characteristics of the earlier Piaggio P.136, a five-seat amphibian flying boat, which first flew in 1948. The most obvious family resemblance is in the use of the P.136's high wing, retaining the cranked 'gull' shape, and also in using the same Lycoming GSO-480 pusher engines.

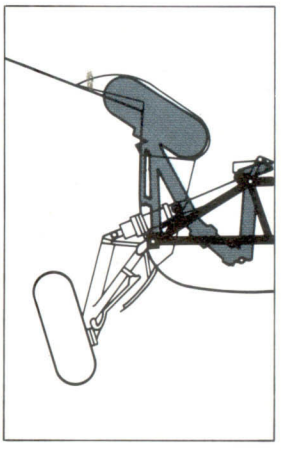
Initial flight by the first P.166 prototype took place in November 1957 and first deliveries less than 18 months later. More than 30 were built for feederline use in Germany, Greece and Australasia, carrying ten passengers, and as executive aircraft, with layouts for six to eight people. The P.166 was also available in different versions for aerial-survey, ambulance and freight duties. The P.166B (named *Portofino*) flew in March 1962. This model, of which only five were built, featured more powerful Lycoming IGSO-540-A1A engines, a longer nose and a new cabin layout, revised to accommodate between six and ten passengers. As many as 12 people could be seated in the two P.166Cs which had new housing for the main undercarriage to provide greater cabin volume. A variant designed for search and surveillance duties was developed, known as the P.166S, of which 26 were built. First flown in 1975 – almost 20 years after the prototype – the P166-DL2 features a number of significant changes: internal fuel capacity was substantially increased by the adoption of integral wingtip tanks, while maximum take-off weight of the variant was increased by 300 kg (662 lb). The DL2 is powered by 380-hp Lycoming engines.

The latest addition to the Piaggio family is the P.166-DL3, which introduces turbine power: two 587-shp Avco Lycoming LTP101-600 turboprops are fitted, driving three-blade Hartzell propellers. Only the changes necessary to accommodate the new engines provide any detail difference between the DL2 and DL3 models. The large cabin door has been maintained and the DL3 has been promoted for use in geophysical-survey and aerial-photography work. A military version with a left-hand side cargo-loading door and stronger floor was built for the Italian and South African air forces; more than 50 P.166Ms were produced.



P.166-DL3

Type: light transport
Maker: Rinaldo Piaggio SpA, Industrie Aeronautiche e Meccaniche
Span: 13.51 m (44 ft 4 in)
Length: 11.9 m (39 ft 3 in)
Height: 5 m (16 ft 5 in)
Wing area: 26.56 m^2 (286 sq ft)
Weight: maximum 4300 kg (9480 lb); empty 2126 kg (4688 lb)
Powerplant: two 587-shp Lycoming LTP101-600 turboprops
Performance: maximum speed 417 km/h (259 mph) at 3050 m (10 000 ft); range with maximum payload and 30 min reserves 741 km (460 miles)
Payload: seats for up to 10
Crew: 1
Production: minimum 150 (of all models)



Left: A P.166-DL3
Below: The main landing gear, hinged to a tubular frame. Brakes and retraction mechanism are both hydraulically operated
Far left below: A P.166 of Charrington United Breweries
Below left: A P.136 amphibian taxies ashore

Falcon 20, Dassault-

FIRST FLIGHT 1963

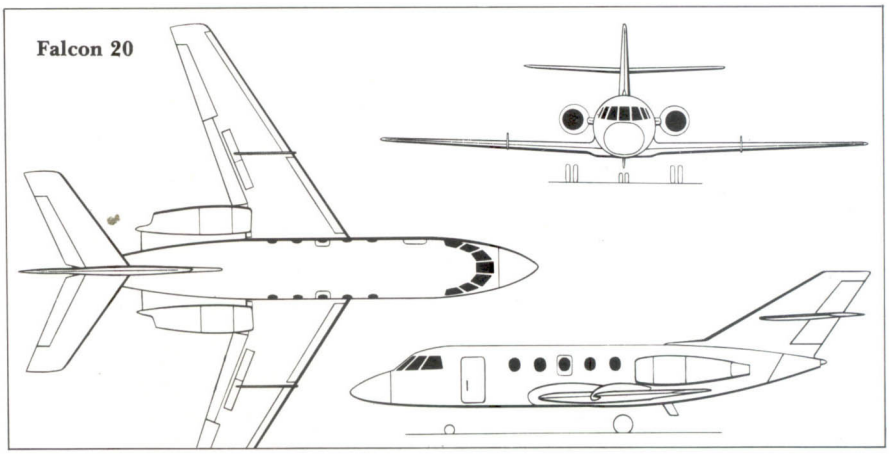
DASSAULT'S Falcon 20, otherwise known as the Fan Jet Falcon or Mystère 20, is in widespread use as an executive jet. Its original name was the Mystère 20, and development was undertaken jointly with Sud-Aviation. The prototype first flew in May 1963 and was powered by two 1497-kg (3300-lb) thrust Pratt & Whitney JT12A-8 turbojets with SNECMA thrust reversers. It was later fitted with General Electric CF700-2B turbofans and these became standard for production aircraft.

Other modifications on production versions included a 1-m (3ft 3-in) increase in wing span for a lower approach speed, a longer cabin, and twin instead of single wheels on the three undercarriage legs. The first production aircraft flew in January 1965 and French certification and US type approval were granted in June of that year.

The Business Jets division of Pan American placed a first order for 54 soon after early flights in 1963, and the Mystère 20 was marketed in the USA as the Fan Jet Falcon. By late 1977 orders had reached 427, including 239 for the United States. Some have seen airline use, particularly with Pacific-based Air Nauru.

The production version in 1979 was the Falcon 20F, with more powerful turbofans in place of the original engines, bigger fuel capacity and more high-lift devices for take-off and landing. These consist of slotted slats outboard of the wing fences, and simple slats inboard of them.

Other Falcon 20 roles have included navigational aid calibration, aerial survey and photography.



Four aircraft, designated Falcon STs, have had Mirage combat radar and navigation installations for the French air force. A cargo version was developed by Little Rock Airmotive, the prototype flying in May 1972. The Federal Express Corporation ordered 33 of these, which became known as Falcon D Cargo Jets. They have an upward-opening cargo door in the left side and a strengthened freight floor, and fly frequent night services delivering freight and mail.

Another prolific version is the Falcon 20G Guardian for maritime surveillance, 41 of which have been ordered by the US Coast Guard. These have 2290-kg (5050-lb) Garrett-AiResearch ATF3-6 turbofans which can be retrofitted to existing aircraft.

Falcon 20F

Type: executive transport
Maker: Avions Marcel Dassault-Breguet Aviation
Span: 16.3 m (53 ft 6 in)
Length: 17.15 m (56 ft 3 in)
Height: 5.32 m (17 ft 5 in)
Wing area: 41 m^2 (440 sq ft)
Weight: maximum 13 000 kg (28 660 lb); empty 7530 kg (16 600 lb)
Powerplant: two 2041-kg (4500-lb) General Electric CF700-2D-2 turbofans
Performance: maximum cruising speed 862 km/h (536 mph) at 7620 m (25 000 ft); range 3350 km (2080 miles)
Payload: 1180 kg (2600 lb); seats for up to 14 passengers
Crew: 2
Production: 413 by January 1980 (plus 41 Guardian)

Top: A Dassault-Breguet Falcon 20DC, which in Federal Express service – Little Rock, Arkansas – bears the name Theresa
Left: Bearing the PanAm logo on their engine pods, but carrying a French registration, two Falcons make a test flight over water

Falcon 10, Dassault-Breguet

FIRST FLIGHT 1970

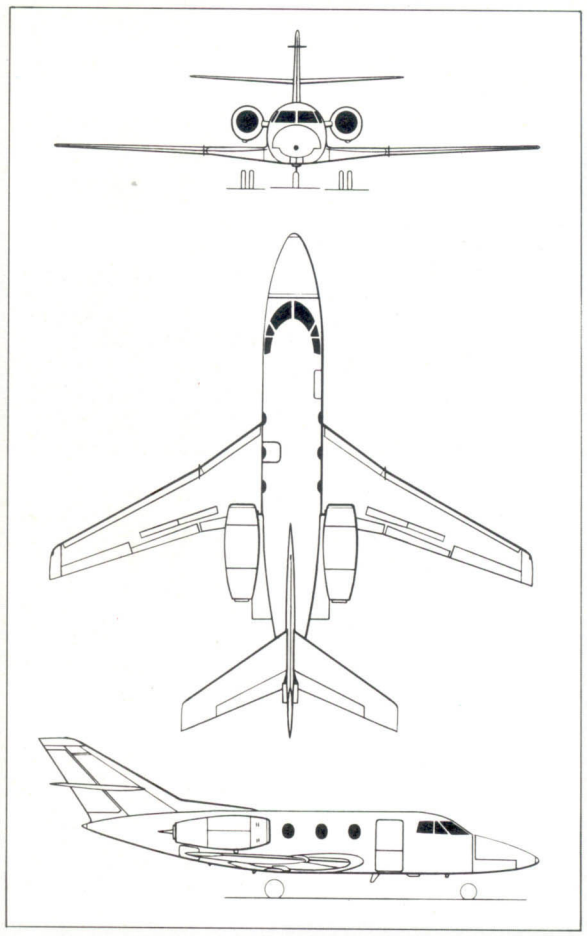
THE Falcon 10 'Mini Falcon' is the smallest in the range of business jets manufactured by France's Avions Marcel Dassault-Breguet Aviation and first flew on December 1, 1970 – seven years after the first flight of its larger brother the Mystère/Falcon 20.

The aircraft was first announced in June 1969 and was conceived as a scaled-down version of the Falcon 20 of about three-quarters the power and two-thirds the weight, providing accommodation for two crew and four to seven passengers. The prototype was powered by a pair of 1340-kg (2954-lb) thrust General Electric CJ610-6 turbojet engines pending delivery of the Garrett-AiResearch TFE731-2 turbofans which powered production versions. These engines were installed in the second prototype which flew on October 15, 1971, and which was subsequently used to test the French-designed Larzac turbofan at that time also being considered as a potential Falcon 10 powerplant.

Like its stablemates from AMD's Bordeaux factory, the Falcon 10 gained ready acceptance among business operators in the United States. The Falcon Jet Corporation, which markets Falcons in North America, placed an initial order for 54 aircraft with options on a further 106 and deliveries began in November 1973. The Falcon 10 is the only business jet certificated by the United States Federal Aviation Administration with no life-limitation on major components; other types are restricted to a given number of hours, after which certain structural components must be replaced. The Falcon 10's airframe is manufactured from high-strength non-zinc aluminium alloy and designed on a fail-safe principle, all loads having multiple stress paths to avoid catastrophic failure in the event that one component should fail.

Production of the Falcon 10 is approaching 200 aircraft. Though primarily a business and corporate transport, the Falcon 10 is also employed as an air ambulance and serves as a navigation trainer and communications aircraft with the French navy. Three machines designated Mystère-Falcon 10MER are used as intruders for training Super Etendard pilots and for calibrating shipborne radars. The navy has an option on a further two.

Production at the Istres plant is running at a rate of two aircraft per month with parts coming from factories in Italy, Spain and France.



Falcon 10

Type: business and corporate transport
Maker: Avions Marcel Dassault-Breguet Aviation
Span: 13.08 m (42 ft 11 in)
Length: 13.85 m (45 ft 5 in)
Height: 4.61 m (15 ft 1½ in)
Wing area: 24.1 m^2 (259 sq ft)
Weight: maximum 8500 kg (18 740 lb); empty 4880 kg (10 760 lb)
Powerplant: two 1466-kg (3230-lb) st Garrett-AiResearch TFE731-2 turbofans
Performance: maximum cruising speed 915 km/h (568 mph) at 9145 m (30 000 ft); range 3555 km (2209 miles) with 4 passengers and IFR reserves
Payload: 1060 kg (2337 lb); seats for up to 7 passengers
Crew: 2
Production: 151 delivered, (194 ordered), by 1980

Below: A Falcon 10 at Harlingen, Texas in October 1978. The aircraft is a scaled-down version of the successful Falcon 20
Bottom: An American-registered Falcon 10. To ease the problems of selling in the US, it is marketed by the Falcon Jet Corporation

Falcon 50, Dassault-Breguet

FIRST FLIGHT 1976

Left and below: The trijet Falcon 50, like its smaller namesakes, has been widely sold in the United States. Even before the prototype made its maiden flight, 50 options had been taken, the bulk from the US. It offers operators an intercontinental business jet which uses many Falcon 20 components

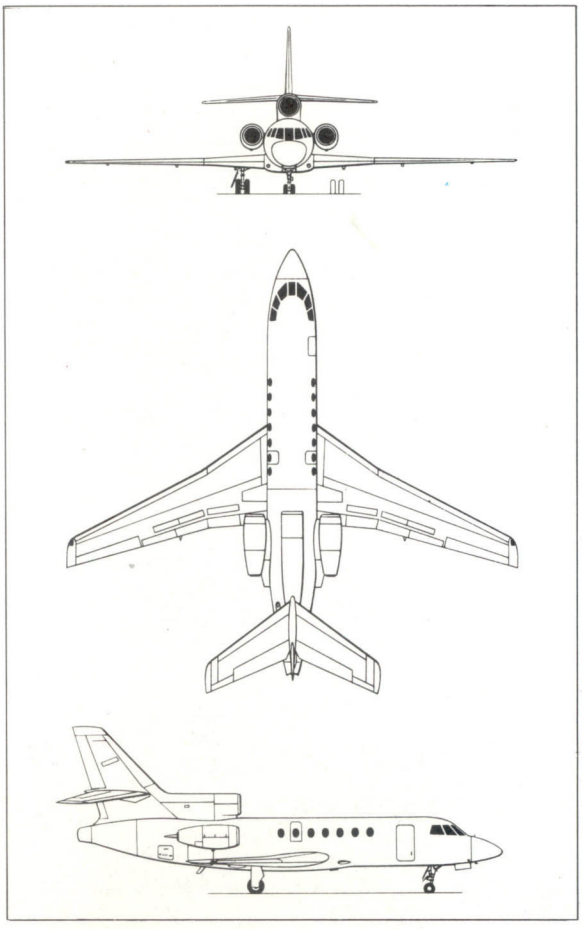
DASSAULT-Breguet's search for an intercontinental-range business jet to add to their existing Falcon 10/20 line produced a series of design studies in the early 1970s based on the Falcon 20 airframe. In 1974 plans for a larger twin-jet aircraft, the Falcon 30, were dropped in favour of the Falcon 50 which was to use many basic Falcon 20 components coupled to a three-engine layout and improved wing design. The same basic fuselage cross-section was to be used, but lengthened to offer more space for fuel and baggage. Passenger accommodation would be similar to the earlier aircraft, but range and operating economics of the aircraft were to be improved by a substantial amount.

The Falcon 50 was announced in May 1974 and the first prototype flew on November 7, 1976. After initial flight testing, Falcon 50 No 01 returned to the factory for the installation of a production-standard supercritical-airfoil wing based on the advanced aerodynamics of the Dassault Mercure jet airliner, and the modified prototype Falcon 50 was flown again on May 6, 1977, making its public debut at the Paris Air Show during the following month.

On October 9, 1977 the first prototype appeared at the US National Business Aircraft Association's convention in the United States and set two world records for non-stop straight-line distance and speed in its class, on the return transatlantic flight from Teterboro, New Jersey to Le Bourget, Paris. The Falcon 50 is powered by three Garrett-AiResearch turbofans, two of them pod-mounted on either side of the rear fuselage and the third fed by an S-duct ahead of the fin. A second prototype joined the test programme on February 16, 1978, followed by the first pre-production aircraft on June 13, 1978. The third aircraft established a further record in September 1978 with a Chicago-Paris flight in 8 hours 30 min.

Fifty options had been taken by customers by the time the prototype Falcon 50 flew, most of the orders coming from the United States.

The tri-jet Falcon 50 was certificated in France and the United States in the spring of 1979 and the first production aircraft was delivered across the Atlantic to the American distributors, Falcon Jet, who had placed 70 of the 100-plus Falcon 50 orders held by Avions Marcel Dassault-Breguet Aviation by the end of 1979.



Falcon 50

Type: business and corporate transport
Maker: Avions Marcel Dassault-Breguet Aviation
Span: 18.86 m (61 ft 10½ in)
Length: 18.3 m (60 ft 0½ in)
Height: 6.9 m (22 ft 7½ in)
Wing area: 46.83 m^2 (504 sq ft)
Weight: maximum 17 000 kg (37 480 lb); empty 9000 kg (19 840 lb)
Powerplant: three 1680-kg (3700-lb) st Garrett-AiResearch TFE731-3-1C turbofans
Performance: maximum cruising speed 870 km/h (540 mph); range 6950 km (4318 miles)
Payload: seats for 8 passengers
Crew: 2
Production: 117 ordered by 1980

Learjets

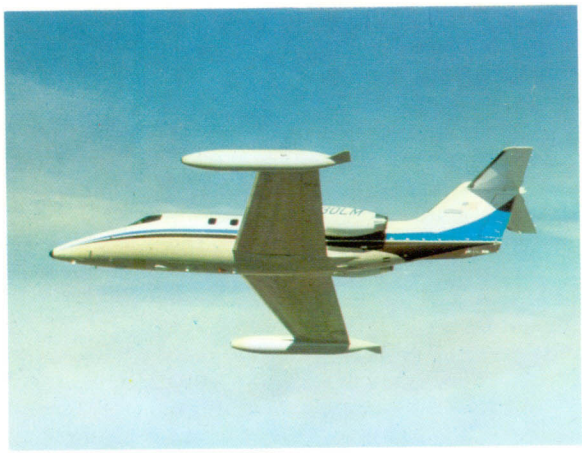
FIRST FLIGHT 1963

IN their several versions, Learjets are probably the most familiar of all business jets. The design was conceived at the end of the 1950s by William Powell Lear Snr, soon known to aviation simply as Bill Lear, one of the most renowned figures in American aviation. He invested about $10 million in the new project. Earliest design studies were done in Switzerland, because the Learjet was to be styled after the P-16 Swiss fighter-bomber. Then in 1963 Lear opened a factory at Wichita. Late that year the prototype Learjet 23 made its first flight. It went through its FAA-certification trials in just nine months, and only a year had gone by when the first production aircraft was delivered to a customer. This was the first of 73 orders existing then – a fitting reply to the sceptics who had claimed there was no market for such an aircraft. The T-tailed Learjet looked simple but elegant, could fly six passengers at a height of 12 500 m (41 000 ft) and at up to 870 km/h (540 mph), and could operate at about 50 cents a mile using relatively small airports. It soon became a familiar sight in general aviation circles, gained some world transcontinental speed records, and achieved a timed climb distinction of 12 300 m (40 000 ft) in 7 min 21 sec.

While the aircraft itself was successful, Learjet Industries was less so, and a welcome transaction took place in 1967 when industrialist and business aircraft operator Charles C Gates bought Bill Lear's share of the business, eventually turning it into the Gates Learjet Corporation.

The Learjet airframe is a strong one, and structural tests on the first aircraft set new standards. With eight wing spars instead of the usual two or three, and many other similar 'strong-points', it is very much a 'fail-safe' design. The Model 23 was soon developed into the 24, with several improvements, including an extra permissible 227 kg (500 lb) take-off weight. In 1966 a Learjet 24 flew round the world in 50 hours 20 min, establishing 18 world records. Refinements to the production Learjet 24 included an even thicker bird-proof windshield, engine-fire protection and new cabin pressurization.

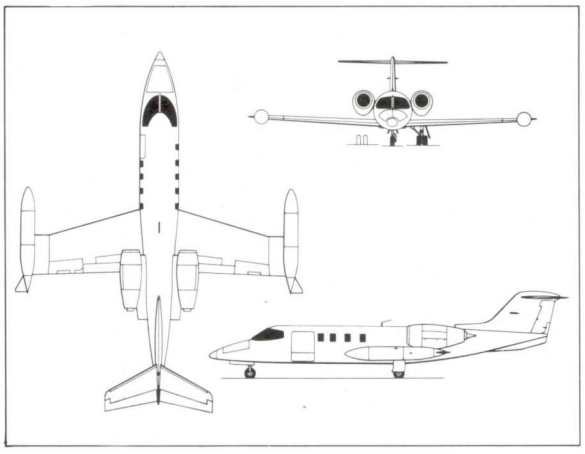
In the light of the success with Learjet 23s and 24s, the company saw prospects for bigger and better developments of the basic airframe. A fuselage stretch led to the Model 25. Originally this was just 0.6 m (2 ft) longer than the 24, and with bigger wingtip fuel tanks holding 860 litres (190 Imp gal).



Above left: A Swissair Learjet ambulance; the early design studies were done in Switzerland
Above: A Model 25 at the Midland-Odessa Regional Air Terminal, Texas, in September 1973
Left: A Model 24; a similar machine established 18 world records when it flew round the world in 50 hours 20 min in 1966
Above right: A Learjet Longhorn with its upturned wingtips (winglets) which reduce drag and increase range

Learjet 50 Longhorn

1 Radome
2 Weather radar scanner
3 Radar tracking mounting
4 Nose compartment construction
5 Baggage bay fire extinguisher
6 Windscreen emergency de-icing alcohol tank
7 Nose compartment access doors
8 Radio and electronics compartment
9 Nose undercarriage wheel well
10 Forward baggage compartment
11 Underfloor emergency oxygen bottle
12 nosewheel doors
13 Nosewheel
14 Incidence vane
15 Pitot tube
16 Forward pressure bulkhead
17 Windscreen de-icing air ducts
18 Curved windscreen panels
19 Instrument panel shroud
20 Instrument panel
21 Rudder pedals
22 Control linkages
23 Cockpit floor level
24 Seat adjusting handle
25 Pilot's seat
26 Control column handwheel
27 Centre radio and instrument console
28 Engine throttles
29 Co-pilot's seat
30 Cockpit roof construction
31 Cabin bulkhead
32 Cabin roof frames
33 Seat mounting frames
34 Folding table
35 Handrail
36 Entry doorway
37 Upper door segment
38 Lower door segment/integral steps
39 Door latches
40 Fuselage frame and stringer construction
41 Cabin window panel
42 Door hinge torque tube
43 Passenger seating, 8-seat layout
44 Cabin wall trim panels
45 Three-seat settee
46 Cabin sidewall heater duct
47 Drinks cabinet
48 Wash basin
49 Toilet compartment, optional rear cabin position
50 Toilet compartment folding doors
51 Cabin roof air-conditioning duct
52 Baggage door/emergency exit
53 VHF/UHF aerial
54 Baggage door open position
55 Right wing fence
56 Wing integral fuel tank
57 Fuel system piping
58 Wing skin panel joint strap
59 Fuel filler cap
60 Right navigation light, green
61 Right winglet
62 Winglet honeycomb construction
63 Static dischargers
64 Fixed portion of trailing edge
65 Right aileron
66 Aileron servo tab
67 Cable control linkage
68 Right single-slotted flap
69 Flap guide rail
70 Spoiler/speedbrake
71 Fuselage skin plating
72 Air-conditioning system evaporator
73 Wing attachment fuselage double frames
74 Baggage compartment
75 Pressurization valve
76 Cabin air blower
77 Area ruled fuselage centre section
78 Rear pressure bulkhead
79 Fuselage fuel tank
80 Fuel filler cap
81 Engine pylon construction
82 Right engine intake
83 Garrett AiResearch TFE731-3A turbofan
84 Engine fire extinguisher bottle
85 Bleed air ducting
86 Engine mounting beam
87 Fan air exhaust duct
88 Core engine 'hot-stream' exhaust
89 Pylon tail fairing
90 Ram air intake
91 Hydraulic reservoir
92 Batteries
93 Air-conditioning plant
94 Fin root fillet
95 Five-spar tailfin construction
96 VOR/ILS aerial
97 Elevator hinge control links
98 ADF sense aerial cable
99 VHF aerial
100 Tailplane trim jack
101 Anti-collision light
102 Right tailplane
103 Leading-edge electrical de-icing
104 Elevator horn balance
105 Right elevator
106 Tail navigation light
107 Tailplane pivot mounting
108 Elevator torque tube
109 Left elevator construction
110 Static dischargers
111 Elevator horn balance
112 Tailplane construction
113 Balance tab
114 Rudder construction
115 Rudder trim tab
116 Tailcone
117 Ventral fin
118 Rudder hinge control
119 Venting air louvres
120 Tailcone access door
121 Rear baggage bay
122 Pylon engine mountings
123 Detachable engine cowlings
124 Rear baggage door, open position
125 Left engine intake duct
126 Intake lip bleed air de-icing
127 Wing root trailing-edge fillet
128 Wing spar/fuselage attachment joints
129 Undercarriage hydraulic retraction jack
130 Main undercarriage mounting rib
131 Flap hydraulic jack linkage
132 Spoiler/speedbrake
133 Left single-slotted flap construction
134 Aileron trim tab
135 Servo tab
136 Aileron cable control
137 Left aileron construction
138 Fixed portion of trailing edge
139 Left winglet
140 Static dischargers
141 Wingtip strobe light, white
142 Winglet rib construction
143 Left navigation light, red
144 Fuel filler cap
145 Eight-spar wing construction
146 Wing skin panel joint strap
147 Left wing integral fuel tank



Learjet 35A

Type: light executive transport
Maker: Gates Learjet Corporation
Span: 12.04 m (39 ft 6 in)
Length: 14.83 m (48 ft 8 in)
Height: 3.73 m (12 ft 3 in)
Wing area: 23.53 m^2 (253.3 sq ft)
Weight: maximum 7711 kg (17 000 lb); empty 4132 kg (9110 lb)
Powerplant: two 1587-kg (3500-lb) st AiResearch TFE 731-2-2B turbofans
Performance: maximum cruising speed 859 km/h (534 mph) at 12 190 m (40 000 ft); range 4234 km (2631 miles)
Payload: 1810 kg (3990 lb); seats for up to 8 passengers
Crew: 1 to 2
Production: 1000 (all Learjet variants)

But the aircraft proved to have poor handling, and was soon modified to be 1.25 m (4¼ ft) longer than the Model 24, and to have rectangular instead of oval windows. First flown in 1966, the Learjet 25 was certificated in 1967 and the first delivery made the same year. The 2317-km (1440-mile) route from Wichita to a customer in Boston was flown in 2 hours 45 min.

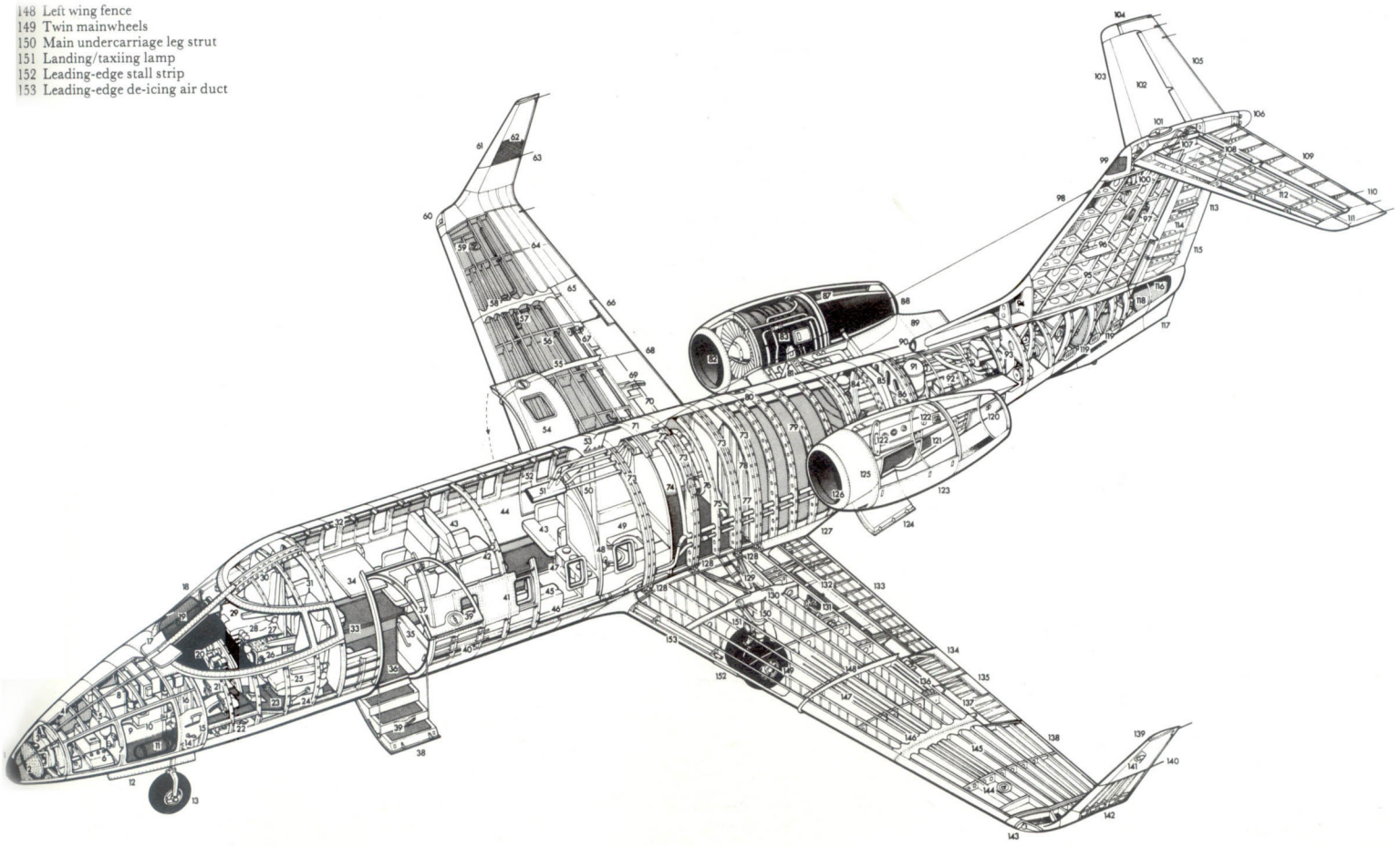
In 1970 the first 25F, longer-range version, entered service with optional conversion from a four- or six-seat arrangement to a two-bed sleeper compartment.

A Learjet was soon fitted with a Garrett-AiResearch turbofan engine to prove the latter's suitability for future aircraft. This was a long and expensive test programme, but it led to the certification in 1974 of the Gates Learjet 35 and 36 intercontinental aircraft, with AiResearch fan-jet engines. The 35 and 36 are almost identical except in fuel capacity and accommodation.

Another major change was the re-shaped Learjet leading edge, reducing approach speeds by up to 33 km/h (21 mph). From mid 1976 Century III series Learjets (24, 25, 35, and 36 Models) had the new wing leading edge.

The latest Learjet Longhorn 28/29s have up-turned wingtip shapes, termed winglets, which reduce induced drag and lead to more range. Larger Longhorns, called the 54/55/56 series, were scheduled for delivery in 1980. Externally the same, they have different fuel capacities giving ranges up to 5745 km (3570 miles). The first Longhorn 55 flew on April 19, 1979.

148 Left wing fence
149 Twin mainwheels
150 Main undercarriage leg strut
151 Landing/taxiing lamp
152 Leading-edge stall strip
153 Leading-edge de-icing air duct



Gulfstream I, Gulfstream American

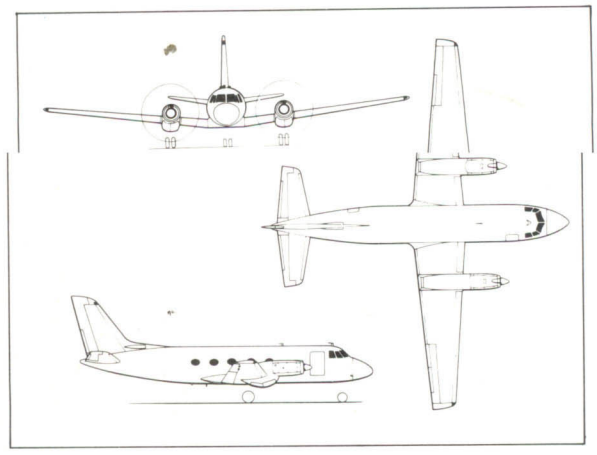
FIRST FLIGHT 1958

IN the mid 1950s the bulk of the fleet of corporate transport aircraft in the United States was made up of converted surplus military aircraft and ex-airline DC-3s. In 1956 Grumman Aircraft commenced design studies for a long-range business aircraft which would be powered by the turboprop engines then coming into airline use. Business operators were then highly sceptical of the turboprop, which was still an unknown quantity, and contemporary piston engines were considered more efficient and reliable than the usual contemporary turbines.

Undeterred, Grumman went ahead with a design for an aircraft based on the TF-1 Trader US Navy transport aircraft, with British-made Rolls-Royce Dart engines. Market and design studies showed that an entirely new design was needed and thus evolved the Grumman G-159 Gulfstream, which first flew on August 14, 1958 and was at the time the largest aircraft purpose-designed for business and corporate use. The Gulfstream (subsequently known as Gulfstream I when the jet Gulfstream II appeared in 1966) was certificated in 1959 and gained ready acceptance among major US corporations, to whom it offered an opportunity to operate worldwide entirely independently of external airfield services. The aircraft was available with any desired interior configuration from four to 19 passengers; typical executive interiors catered for ten passengers.

When production ended in 1969, 200 Gulfstream Is had been delivered to companies and heads of state worldwide. The US Navy and Coast Guard also bought Gulfstreams. Although no major changes in configuration or specification were made during the ten-year production run, in 1979 the Gulfstream American Corporation, which acquired rights and tooling for Gulfstreams I, II, and III from Grumman Aerospace Corporation, announced plans for a stretched 32 to 38-seat commuter airliner version of the aircraft. A prototype conversion designated Gulfstream IC flew for the first time on October 25, 1979.

In January 1980 no plans had been finalized for series production, but Gulfstream American will be offering the 3.2-m (10 ft 7-in) fuselage extension as a retrofit for existing Gulfstream Is following certification of the prototype in May 1980 at a cost of $1.25 million.



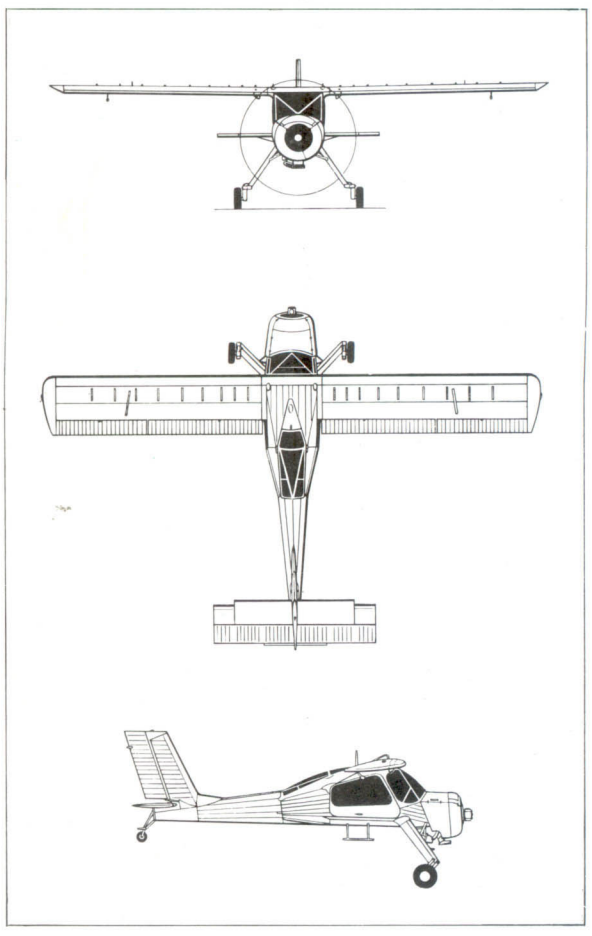
Gulfstream I

Type: business, corporate and third-level airline transport
Maker: Grumman Aerospace Corporation (type certificate now owned by Gulfstream American Corporation)
Span: 23.88 m (78 ft 4 in)
Length: 19.43 m (63 ft 9 in)
Height: 6.99 m (22 ft 11 in)
Wing area: 56.7 m^2 (610 sq ft)
Weight: maximum 16 330 kg (36 000 lb); empty 9934 kg (21 900 lb)
Powerplant: two 2210-shp Rolls-Royce Dart 529-8X turboprops
Performance: maximum cruising speed 572 km/h (356 mph); range with full tanks 4058 km (2540 miles)
Payload: seats for up to 19 passengers (38 passengers in Gulfstream IC Commuter version)
Crew: 2
Production: 200

Top: A Gulfstream I at Reykjavik, Iceland, in March 1979. When production ended in 1969 Grumman had delivered 200 Gulfstream Is. The type can carry 19 passengers, or ten in full executive furnishing

Wilga, PZL

FIRST FLIGHT 1962



DESIGN of the PZL-104 Wilga (Thrush) was undertaken at the Centrum Naukowo Produkayjne Samolotow Lekkich PZL-Warszawa (Polish Light Aircraft Science and Production Centre, Warsaw) as a replacement for the Czechoslovakian L-60 Brigadyr general-purpose aircraft. The first prototype Wilga 1 was powered by a 180-hp Narkiewicz WN-6B radial engine and made its maiden flight on April 24, 1962. A complete redesign of the fuselage and tail surfaces followed and the Wilga 2 flew on August 1, 1963 with a 195-hp WN-6RB engine. On December 30 that year, the definitive Wilga C with a 225-hp Continental O-470 engine flew and subsequently was produced in Indonesia as the Lipnur Gelatnik, 39 examples of which were manufactured.

The first series production Wilgas from Poland were Wilga 3As (four-seat utility aircraft for club flying) and Wilga 3Ss (ambulance aircraft) which both had 260-hp Ivchenko AI-14R radial engines. In 1967 the cabin area and undercarriage of the aircraft were extensively redesigned and the aircraft was redesignated Wilga 35 (260-hp AI-14R engine) and Wilga 32 (230-hp Continental O-470K), the first examples making their maiden flights on July 28, 1967 and September 12, 1967 respectively.

The current production versions of the Wilga are: Wilga 35A (aeroclub use), 35P (passenger-carrying light transport and liaison aircraft), 35R (agricultural aircraft which can carry 270 kg [595 lb] of chemicals in an under-fuselage hopper), and the 35S air ambulance. The Wilga's excellent handling characteristics make it an ideal aircraft for use in the agricultural role, particularly when small areas have to be sprayed. The 35R is also ideal for agricultural pilot training in that its dual controls can give trainee pilots first hand experience under working conditions. Production of this unusual, insect-like STOL aircraft exceeds 400 machines, which are currently operating in Austria, Bulgaria, Czechoslovakia, Egypt, East Germany, West Germany, Hungary, Poland, Romania, United States, Spain, Switzerland, United Kingdom, USSR, and Venezuela. In addition to its specialist roles the Wilga can also be operated on skis or floats and is popular both in eastern and western countries in its role as a glider tug.

Wilga 35A

Type: light utility and agricultural aircraft
Maker: Centrum Naukowo Produkayjne Samolotow Lekkich PZL-Warszawa; Lipnur, Indonesia
Span: 11.12 m (36 ft 5¾ in)
Length: 8.1 m (26 ft 6¾ in)
Height: 2.94 m (9 ft 7¾ in)
Wing area: 15.5 m^2 (167 sq ft)
Weight: maximum 1300 kg (2866 lb); empty 850 kg (1874 lb)
Powerplant: one 260-hp Ivchenko AI-14RA radial engine
Performance: maximum speed 201 km/h (125 mph); range 680 km (422 miles)
Payload: chemical spraying equipment, capacity 270 kg (595 lb); seats for up to 4 passengers
Crew: 1
Production: minimum 400 by 1980

Top and above left: US-registered PZL Wilga 35P. The long-legged undercarriage gives a good STOL performance, which makes the Wilga an excellent agricultural aircraft

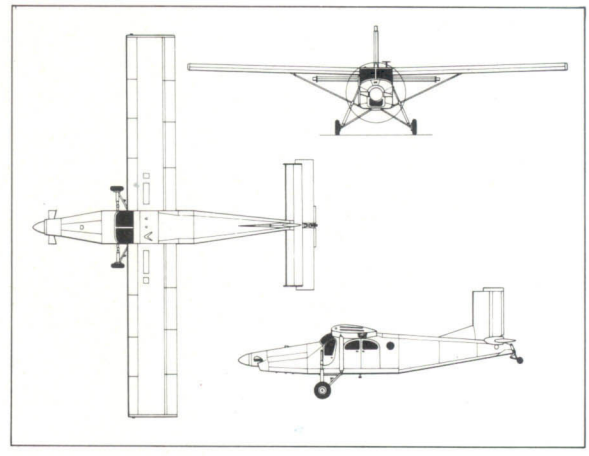
Turbo-Porter, Pilatus

FIRST FLIGHT 1961

THE first flight of the Turbo-Porter on May 2, 1961, was almost two years after the prototype Pilatus PC-6 Porter appeared. The type was to become one of the most versatile of all light STOL (short take-off and landing) transports. Design work began in 1957, leading to five prototypes followed by 20 pre-series aircraft.

The PC-G/340 basic version was powered by the 340-hp Lycoming GSO-480 engine. In December 1961, the prototype PC-6/350 flew under the power of a 350-hp fuel-injected Lycoming IGO-540 at the same gross weight of 1950 kg (4321 lb). Both the 340 and 350 models were followed by H1 and H2 versions of greater weight. In mid-1966, forward opening doors on each side of the cockpit were introduced, as were a double door on the left side of the cabin and a large rearward-moving sliding door on the right side.

The powerplant chosen for the PC-6/A Turbo-Porter was the French Turboméca Astazou II which was fitted with a reversible-pitch propeller. Again H1 and H2 versions of the PC-6/A had increased gross weight. A 523-shp version of the 630-shp Astazou X, and the 700-ehp Astazou XII equipped some PC-6/AX-H2s and similar models. In 1964 an American-engined Turbo-Porter known as the PC-6/B flew with a Pratt & Whitney PT6A-6 turboprop. This model was built in the US by Fairchild Hiller and was called at first the Heli Porter. (All models are now called Porter.) The year 1965 saw the first flight of a Porter with a third turbine engine, this time the Garrett-AiResearch TPE331, flown by Fairchild as the PC-6/C-H2.



The basic form of the Porter features a conventional-wheeled undercarriage (oversize wheels and tyres are available) but the type can be flown with floats or skis. Examples have been used in agriculture for crop-spraying and water bombing, for aerial-survey and photography work, for supply dropping or conventional cargo duties, for ambulance flights (there is accommodation for two stretchers), parachuting and target towing.

The Turbo-Porter can be fitted with two underwing tanks of 190 litres (42 Imp gal) capacity. The type is in airline service in remote regions and has been used in undercover operations in Laos. AU-23A Peacemaker is the designation of an armed counter-insurgency variant supplied to the USAF for use by the Royal Thai Air Force.

PC-6/B2-H2

Type: light STOL transport
Maker: Pilatus Flugzeugwerke AG; Fairchild Industries
Span: 15.13 m (49 ft 8 in)
Length: 11 m (36 ft 1 in)
Height: 3.2 m (10 ft 6 in)
Wing area: 28.8 m^2 (310 sq ft)
Weight: maximum 2200 kg (4850 lb); empty 1215 kg (2678 lb)
Powerplant: one 550-hp Pratt & Whitney PT6A-27 turboprop
Performance: maximum cruising speed 259 km/h (161 mph) at 3050 m (10 000 ft); range 1400 km (644 miles)
Payload: seats for up to 7 passengers
Crew: 1
Production: minimum 500 (of all models)

Left: A French Turbo-Porter used by the Centre National de Parachutisme. The wing struts give free-fall parachutists a convenient hand-hold before their exit
Above: A Swiss Turbo-Porter climbs steeply away from its mountain airstrip

Navajo, Piper

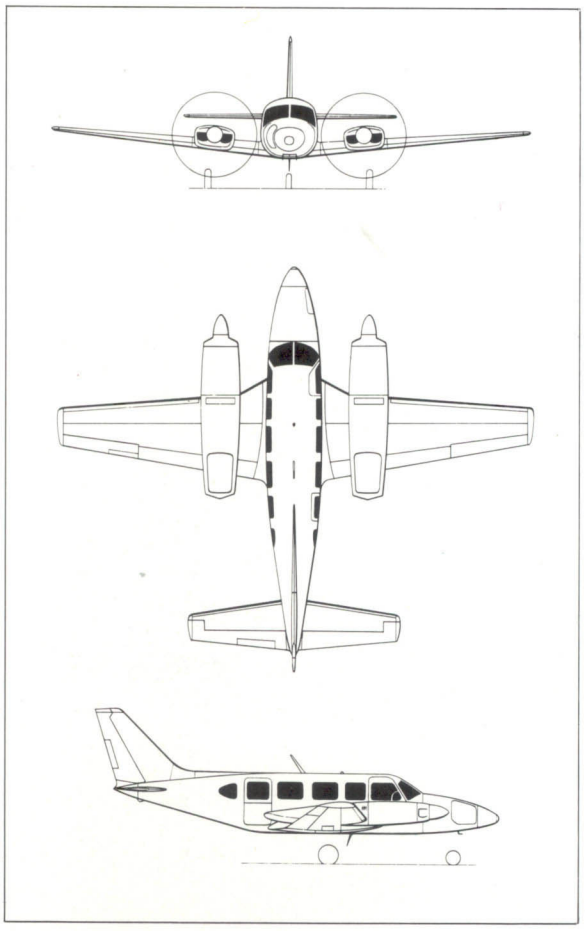
FIRST FLIGHT 1964

THE Piper PA-31-300 Navajo prototype was described as the first of a new family series of large twin-engined executive aircraft available also for commuter airlines and corporate use. The range, which grew to spawn the similar but turboprop-powered Cheyenne series, began with the first flight in September 1964. Power came from two 300-hp Lycoming IO-540 engines which could normally be aspirated or turbocharged.

The Navajo family includes the Turbo Navajo, Navajo C/R, Pressurized Navajo and Navajo Chieftain. The basic model is the Navajo C. Each model in the series comes in Standard, Commuter or Executive versions with differences in seating arrangements and interior cabin layouts. A choice of four electronics and communications packages is available, together with co-pilot's instruments and de-icing equipment options.

The Navajo C has four passenger-seats with a fifth and sixth optional. Six seats are available in the commuter model. Standard equipment includes an aft cabin-division bulkhead and luggage shelf. Four individual seats facing one another across foldaway tables identify the executive version, in which the toilet and refreshment units may be replaced by seventh and eighth seats. Although not announced until 1970, the Pressurized Navajo began as a company project in January 1966 and flew in March 1968. Some 4000 hours of flight and ground testing went into the model, including 850 hours at altitudes up to 8840 m (29 000 ft), the type's certificated maximum operating height. Pressurization comes from turbocharger bleed air, and two engine-driven pneumatic pumps. An environmental control system regulates cabin temperature, purification and dehumidification. The Navajo C/R designation refers to counter-rotating engines as introduced in the Chieftain, a lengthened version, stretched by some 0.61 m (2 ft), and powered by 350-hp counter-rotating engines. The powerplant is one 325-hp Lycoming LTIO-540-F2BD and one 325-hp Lycoming TIO-540-F2BD flat-six turbocharged engines.

Pressures of up to 976 kg/m^2 (200 lb/sq ft) can be accepted by a stronger cabin floor. Main cabin cargo capacity of more than 6 m^3 (210 cu ft) is available, while some 91 kg (200 lb) of baggage or other cargo can be accommodated in a nose freight compartment. Almost 68 kg (150 lb) can be put in the rear area of each engine nacelle.



PA-31P

Type: corporate transport and commuter airliner
Maker: Piper Aircraft Corporation
Span: 12.4 m (40 ft 8 in)
Length: 10.52 m (34 ft 6 in)
Height: 3.99 m (13 ft 1 in)
Wing area: 21.3 m^2 (229 sq ft)
Weight: maximum 3538 kg (7800 lb); empty 2222 kg (4900 lb)
Powerplant: two 425-hp Lycoming TIGO-541-E1A 6-cylinder horizontally opposed engines
Performance: maximum speed 451 km/h (280 mph) at 5475 m (18 000 ft); range 2065 km (1285 miles)
Payload: seats for up to 8 passengers
Crew: 1
Production: current

Top: A Piper PA-31-350 Navajo Chieftain of Air Anglia. This aircraft, formerly registered N608HR, is one of 25 which link 15 British cities with Europe
Above: N7XB, an American-registered Navajo fitted with four-blade propellers

Super King Air, Beech

FIRST FLIGHT 1972

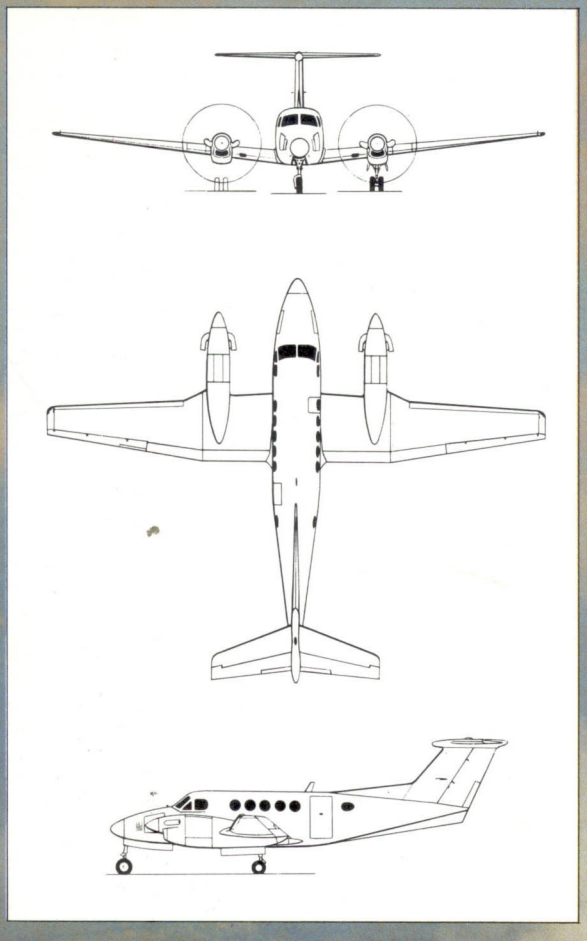
THE Beech Super King Air, top of the company's executive twin range, is a development of the King Air 100, but bears only a superficial resemblance. One major difference is the Super King Air's T-tail, keeping the tailplane well up out of the wing downwash or propeller slipstream. Other changes include a 2.4-m (8-ft) longer wing span, increased cabin pressurization (and consequently tougher fuselage), as well as a higher gross weight mainly taken up in extra fuel capacity to give a longer range.

Design began in late 1970, the first prototype flying in October 1972 and the second flying in December of that year. Construction of the first production aircraft began in the summer of 1973 and FAA certification followed in December. As well as winning keen interest from business users, the Super King Air soon captured military attention, and in 1974 Beech signed a contract with the US Army to supply 34 modified versions – 20 for the Army and 14 for the US Air Force. These were designated C-12As. Three aircraft designated RU-21Js were also supplied to the US Army's fleet of special-mission aircraft, carrying antennae and specially approved to operate at a high weight of 6804 kg (15 000 lb).

In 1975 both the US Army and USAF ordered more C-12As, the Air Force taking another 20 and the Army 16. The total value of the contract was $45 million. The C-12As are essentially standard Super King Airs equipped for two-pilot operation, with accommodation for eight passengers and the capacity to be converted easily for cargo carrying. Survival gear can be stored in a large baggage area.

In 1975 Beech was awarded an FAA contract to modify an aircraft for airborne evaluation of radio navigation aids and approach facilities. Two Super King Airs, specially equipped with camera installations, were also ordered by the French Institut Géographique National and delivered in February 1977. These have auxiliary wingtip fuel tanks giving another hour's endurance, and different landing gear allowing a higher take-off weight of 6350 kg (14 000 lb). Designated Beech Model 200T, these aircraft can be used in high-altitude photographic and weather observation roles.

The Maritime Monitor 200T is equipped with advanced surveillance and monitoring systems. It is intended for use as an offshore patrol and search and rescue aircraft.



Super King Air 200

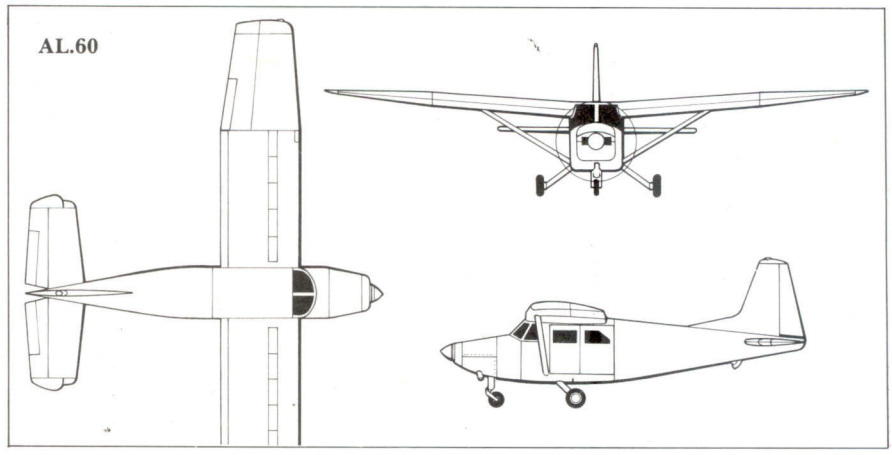
Type: passenger or executive light transport
Maker: Beech Aircraft Corporation
Span: 16.61 m (54 ft 6 in)
Length: 13.34 m (43 ft 9 in)
Height: 4.57 m (15 ft)
Wing area: 28.15 m^2 (303 sq ft)
Weight: maximum 5670 kg (12 500 lb); empty 3373 kg (7437 lb)
Powerplant: two 850-shp Pratt & Whitney of Canada PT6A-41 turboprops
Performance: maximum speed 536 km/h (333 mph) at 4570 m (15 000 ft); range 2752 km (1710 miles)
Payload: seats for up to 13 passengers
Crew: 1 to 2
Production: 527 ordered by 1979 (433 by commercial and private operators and 94 military C-12s)

Top: The Super King Air in service in the UK
Below: A US-registered machine. The Super King Air has proved not only to be a very popular executive transport, but has also been used by government and military organizations throughout the world

AL.60 Conestoga, Aermacchi/Lockheed

FIRST FLIGHT 1959

DURING the late 1950s the Lockheed Georgia Company, Marietta, Georgia made a rare venture into the general aviation market with a design for a four to six-seat light utility transport aircraft aimed specifically at South American operators. The one and only American-built prototype Lockheed AL.60 made its maiden flight on September 15, 1959. It was a boxy, robust, all-metal high-wing monoplane with a wide square cabin which could quickly be changed from passenger to all-cargo configuration, and tricycle landing gear which could be replaced with skis or floats for bush flying. The standard seating arrangement is for four to six passengers but these can be replaced by seats without backrests for use by parachutists. The ambulance version could carry two stretchers, one seated patient and one attendant.



It was never Lockheed's intention to manufacture the aircraft in the United States. Instead a subsidiary company – Lockheed/Azcarate SA – was established in Mexico. This plant produced only 18 LASA 60s before all manufacturing and sales rights were sold to Aeronautica Macchi.

The first Italian-built LASA 60 was flown on April 19, 1961, and was subsequently developed and produced in several models which included the AL.60B1 with a 250-hp Continental IO-470-R engine, the B2 variant with a 260-hp supercharged Continental TSIO-470-B powerplant, and the C4 with a conventional tailwheel undercarriage replacing the standard tricycle landing gear. A 340-hp Piaggio-built Lycoming-engined version known as the AL.60C was developed to meet an Italian army requirement for a liaison/utility transport. The final civil versions of the Aermacchi aircraft were the 400-hp AL.60F5 Conestoga, and a tailwheel version of the same aircraft for Canadian operators. Some 100 examples of all models were built in Italy before production terminated in 1972.

The basic AL.60C5 design, with a 340-hp engine, has been produced by the Atlas Corporation in South Africa as the Atlas C4M Kudu which first flew in 1974 and serves with units of the South African air force. A three/four-seat forward air-control aircraft known as the Aermacchi AM-3C was also developed from the basic AL.60 airframe, though modified substantially, and is serving with the air forces of Rwanda and South Africa, under the name of Bosbok.

AL.60F5

Type: utility transport aircraft
Maker: Aeronautica Macchi; Lockheed Georgia Co
Span: 11.99 m (39 ft 4 in)
Length: 8.8 m (28 ft 10½ in)
Height: 3.2 m (10 ft 6 in)
Wing area: 19.55 m^2 (210.4 sq ft)
Weight: maximum 2041 kg (4500 lb); empty 1043 kg (2300 lb)
Powerplant: one 400-hp Avco Lycoming IO-720-A1A piston engine
Performance: maximum speed 254 km/h (158 mph); range 1037 km (645 miles)
Payload: 653 kg (1440 lb); seats for 6 passengers
Crew: 1
Production: minimum 100

Left: An AL.60 of the German firm Aero Photo; the type has been produced in Mexico, Italy and South Africa. It was designed by Lockheed in partnership with Aermacchi for South American operators and can carry four to six passengers or cargo

MU-2, Mitsubishi

FIRST FLIGHT 1963

THE MU-2 turboprop business aircraft was the first original postwar design by the famous wartime manufacturer of the Japanese Zero fighter. The Mitsubishi company began design studies for the MU-2 in September 1959. The construction of a prototype began in 1962 and this aircraft, powered by French-built Turboméca Astazou turboprop engines, made its first flight on September 14, 1963. Two further Astazou-engined MU-2A prototypes were flown before the decision was taken to switch to American-built Garrett-AiResearch TPE331 engines, and the first such MU-2B prototype flew on March 11, 1965.

The early models all had accommodation for up to seven passengers with a two-man crew and, although designed with military applications in mind, the aircraft was marketed principally among business operators, although the Japanese Self Defence Forces use MU-2s in liaison and search-and-rescue roles. The aircraft is of unusual configuration, having a short stubby fuselage into which the main undercarriage retracts and a high, tip-tanked wing which employs spoilers rather than conventional ailerons for roll control. Thirty-four MU-2Bs were built, mostly for American customers who were attracted by its high cruising speeds and its ability to operate happily from short, rough airfields – a rare attribute in sophisticated business aircraft. The basic short-bodied MU-2 airframe has been successively developed through MU-2C, D, F, K, M and P models incorporating engineering and systems improvements, increased fuel tankage, higher gross weights and uprated Garrett engines. One baggage compartment in the MU-2F is situated over the main wheel bays with a capacity of 100 kg (220 lb). The other baggage compartment is situated aft of the main wheel bays and has a capacity of 70 kg (154 lb). There is also additional space allocated for hand luggage at the rear of the cabin.

From the beginning of production the aircraft have been manufactured in Japan and shipped to the United States where Mitsubishi Aircraft International (formerly Mooney Aircraft Inc) assemble and complete them at a San Angelo, Texas, factory.

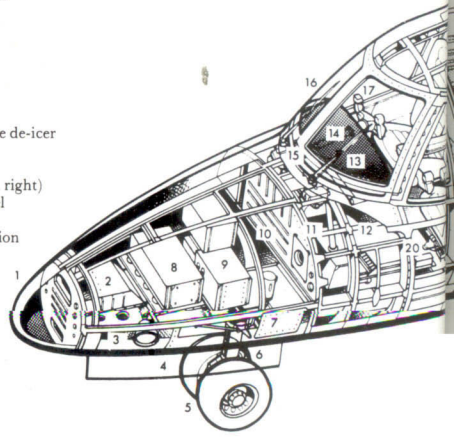
On January 10, 1969 a stretched version, the MU-2G, was flown for the first time. It is distinguished from the short-body models by an additional 1.9 m (6 ft 3 in) of fuselage length and external bulged fuselage fairings to enclose the main undercarriage legs. Depending on internal layout, up to 12 passengers can be carried in this version, which has also been refined through MU-2J, L, and N models. The MU-2N has a cruising speed of 480 km/h (298 mph).

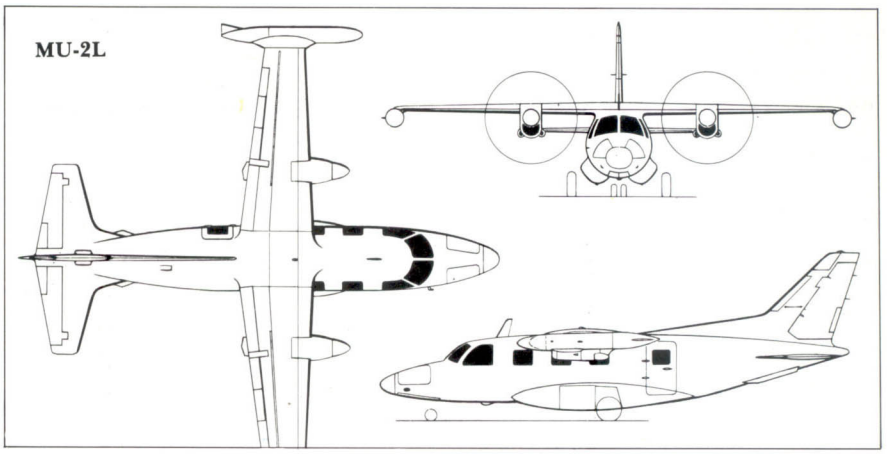
Total production of MU-2s exceeds 500 aircraft of all models. Responding to comments on cabin noise levels, Mitsubishi installed slow-turning four-bladed propellers on the latest MU-2N (long-body) and MU-2P (short body) models, which are now named Marquise and Solitaire. The 6 to 9-seat Marquise cruises at 571 km/h (355 mph), has a range of 2584 km (1606 miles) and can operate out of 660-m (2165-ft) airstrips, while the smaller Solitaire cruises at 576 km/h (358 mph) over 2945 km (1830 miles) and can operate from fields as short as 550 m (1800 ft).

Right: A privately-owned US MU-2. The type is popular in the US because of its ability to operate from short rough airfields – a rare characteristic in business aircraft
Below right: A Mitsubishi MU-2F of the Scandinavian operator Swedair. Though the company is a civilian operator, it includes in its activities target-towing and ground services such as aircraft maintenance and airport operation. It has eight MU-2Fs, all of which are ex-American aircraft

MU-2J

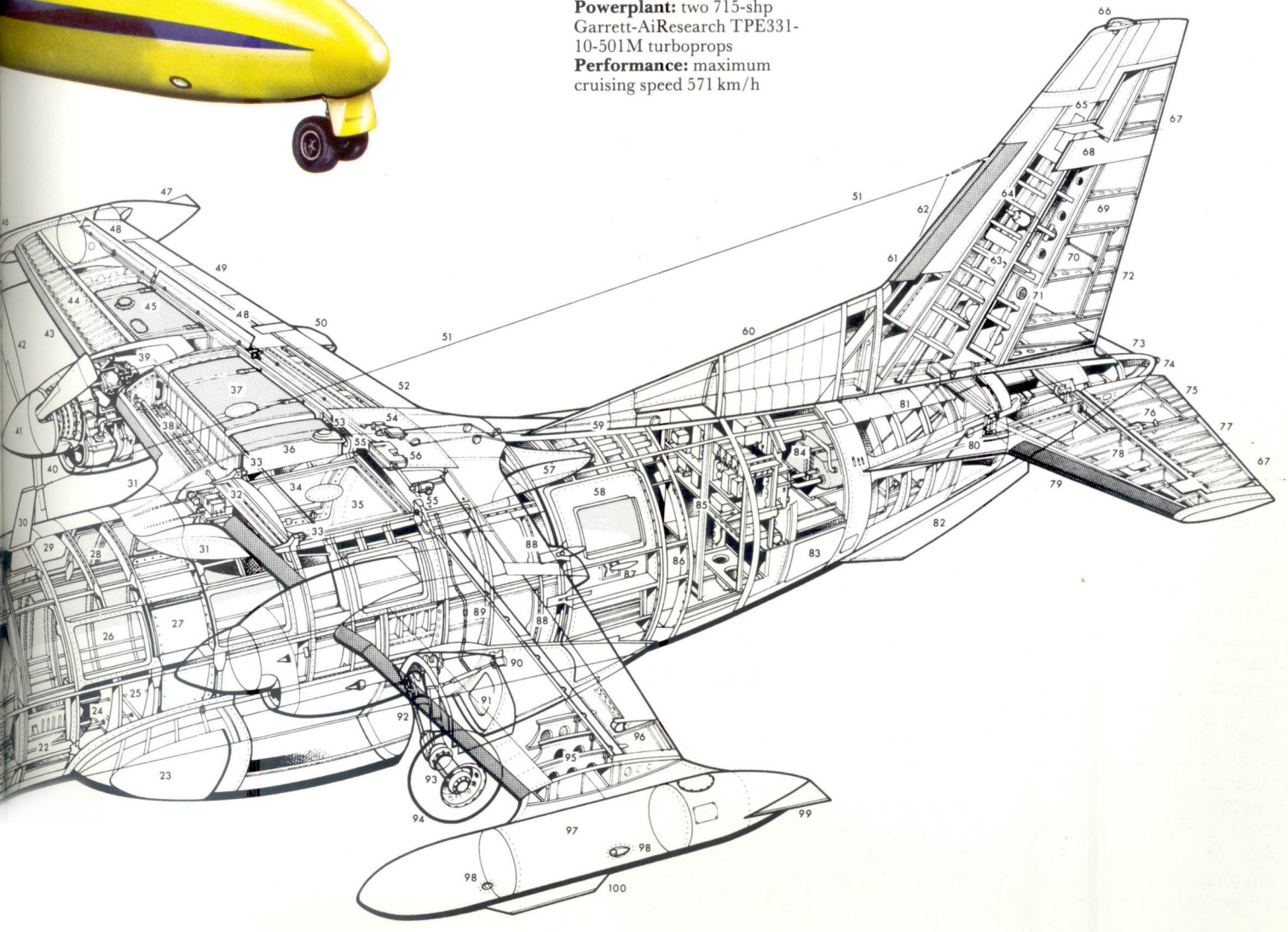
1 Nose cone
2 Hinged nose doors (left and right)
3 Hinged landing and taxi lamps (left and right)
4 Nosewheel doors
5 Forward-retracting twin nosewheels
6 Nosewheel leg
7 Landing-gear access panel
8 Forward electronics compartment
9 Forward battery
10 Bulkhead
11 Control column
12 Rudder pedals
13 Windshield wiper
14 Instrument console shroud
15 Windshield de-icing installation
16 Two-piece curved windshield
17 Control yoke
18 Second pilot's seat
19 First pilot's seat
20 Seat adjustment mechanism
21 Circuit breaker panel
22 Floor support structure
23 Main undercarriage fairing
24 Underfloor control runs
25 Main passenger cabin floor
26 Three-a-side cabin windows
27 Strengthened anti-ice panel
28 Frame and longeron fuselage construction
29 Fuselage skinning
30 Aerial mast
31 Wingroot fairings
32 Leading-edge relay panel
33 Fuselage/front spar attachment points
34 Emergency escape window (right-hand rear)
35 Wing carry-through surface
36 Centre-section fuel tank
37 No 1 right-hand fuel tank
38 Fuel lines
39 Garrett-AiResearch TPE331-6-251M turboprop
40 Intake
41 Airscrew spinner
42 Three-blade Hartzell propeller
43 Pneumatic leading-edge de-icer
44 Leading-edge ribs
45 No 2 right-hand fuel tank
46 Auxiliary tip tank
47 Tip tank fin
48 Spoilers (extended)
49 Trim aileron section
50 Flap track fairing
51 Aerial
52 Inner section double-slotted flap
53 Centre-section anti-collision beacon
54 Spoiler mechanism
55 Fuselage/rear spar attachment points
56 Flap actuator mechanism
57 Wingroot fillet
58 Cabin entry door
59 Air-conditioning ducts
60 Dorsal fillet
61 Pneumatic fin leading-edge de-icer
62 Aerial (to right-hand tailplane)
63 Fin main spar
64 Rudder tab mechanism
65 Antenna
66 Anti-collision beacon
67 Static-dischargers
68 Rudder hinge fairing
69 Rudder construction
70 Rudder tab control
71 Rudder post main beam
72 Rudder tab
73 Tail cone
74 Rear navigation light
75 Elevator tab
76 Tab mechanism
77 Left elevator
78 Tailplane construction
79 Pneumatic leading-edge de-icer
80 Tailplane fillet
81 Control runs
82 Ventral strake (left and right)
83 Electronics access panel
84 Air-conditioning and pressurization installation
85 Aft electronics compartment (main junction box and batteries)
86 Aft cabin coat closet space
87 Door handle
88 Door hinges
89 Fuel dump line (left and right)
90 Undercarriage retraction mechanism
91 Mainwheel door
92 Mainwheel leg
93 Axle
94 Left mainwheel
95 Wing ribs
96 Outer-section flap profile
97 Left auxiliary tip tank
98 Wingtip lights (navigation and strobe)
99 Tip tank fin
100 Tip tank strake





MU-2N Marquise

Type: business and corporate transport
Maker: Mitsubishi Aircraft International Inc
Span: 11.94 m (39 ft 2 in)
Length: 12.02 m (39 ft 5 in)
Height: 4.17 m (13 ft 8 in)
Wing area: 16.55 m^2 (178 sq ft)
Weight: maximum 5250 kg (11 575 lb); empty 3470 kg (7650 lb)
Powerplant: two 715-shp Garrett-AiResearch TPE331-10-501M turboprops
Performance: maximum cruising speed 571 km/h (355 mph); range with 45 min IFR reserves 2584 km (1606 miles)
Payload: seats for up to 9 passengers
Crew: 2
Production: 570 ordered by March 1979 (of all types)



HFB 320 Hansa, MBB

FIRST FLIGHT 1964

IN 1961 the wartime Blohm und Voss company of Hamburg's aviation subsidiary Hamburger Flugzeugbau GmbH, began design studies on their first postwar aircraft project – a twin-jet light transport aircraft designated HFB 320. Heading the design team was Ing Richard Vogt who had been responsible for the wartime Junkers Ju 287 jet bomber project. His design for the HFB 320 was reminiscent of the Ju 287, having the same distinctive sharply forward-swept wings.

The first HFB 320 Hansa Jet made its maiden flight on April 21, 1964. Certification trials of three pre-production prototypes were conducted in Spain where the climate could guarantee uninterrupted testing, and it was during this time that the first aircraft was lost in a crash during spin testing.

The aircraft was certificated in 1967 and customer deliveries began in September of that year. Despite its bizarre appearance in a conservative market, the HFB 320 won prestigious orders, not least from the Rijksluchtvaartschool (Dutch national pilot training school) at Eelde in Holland, and from the Luftwaffe, with whom Hansas serve in VIP-transport, navigation training and experimental roles.

The Hansa Jet was one of the most unusual general aviation aircraft to reach production, principally because of its extraordinary wing arrangement, so designed to keep the main cabin area ahead of the wing roots and thus free of carry-through structure.

The passenger version could accommodate up to 12 seats with a flight crew of two. There is also a freighter version with a maximum payload of 1814 kg (4000 lb) and both versions have quick-change facilities for conversion from one form to the other.

The first 15 aircraft manufactured by Hamburger Flugzeugbau (now part of Messerschmitt-Bölkow-Blohm) were powered by General Electric CJ610-1 turbojets; later models had -5 and -9 variants of this engine. In all, 54 Hansa Jets were manufactured; apart from the Luftwaffe and Dutch orders much of the production went to United States operators as business aircraft.

In late 1977, the German Federal Defence Technology and Procurement Office ordered four Hansa Jet ECMs. The first of these (D-CANO) flew for the first time on August 22, 1979.

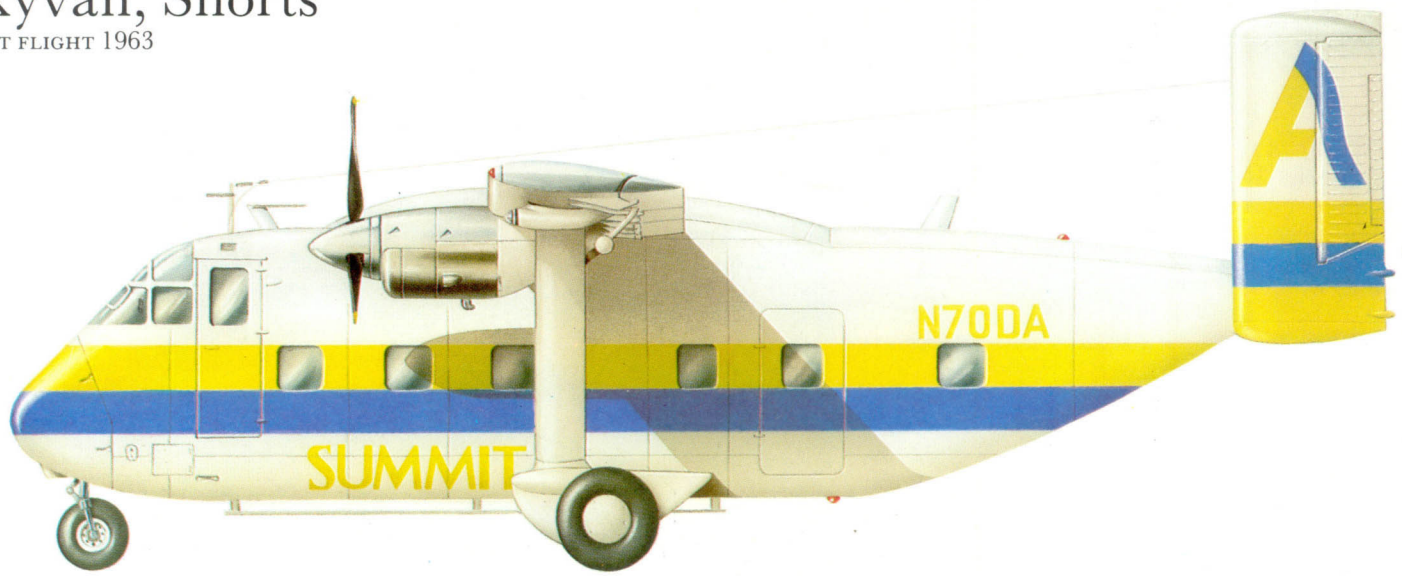
HFB 320 Hansa

Type: business and corporate transport
Maker: Hamburger Flugzeugbau GmbH division of Messerschmitt-Bölkow-Blohm
Span: 14.49 m (47 ft 6 in)
Length: 16.61 m (54 ft 6 in)
Height: 4.9 m (16 ft 1 in)
Wing area: 30.1 m^2 (324 sq ft)
Weight: maximum 9199 kg (20 280 lb); empty 5425 kg (11 960 lb)
Powerplant: two 1406-kg (3100-lb) st General Electric CJ610-9 turbojets
Performance: maximum cruising speed 825 km/h (513 mph); range 2526 km (1570 miles) with IFR reserves
Payload: 1814 kg (4000 lb); seats for up to 12 passengers
Crew: 2
Production: 54

Top and below: The HFB 320 with its distinctive, sharply swept-forward, wings. This feature was previously seen only on the wartime Junkers Ju 287 bomber. The design keeps the main fuselage free of spars and wing root bracing, to give a long unobstructed cabin

Skyvan, Shorts

FIRST FLIGHT 1963

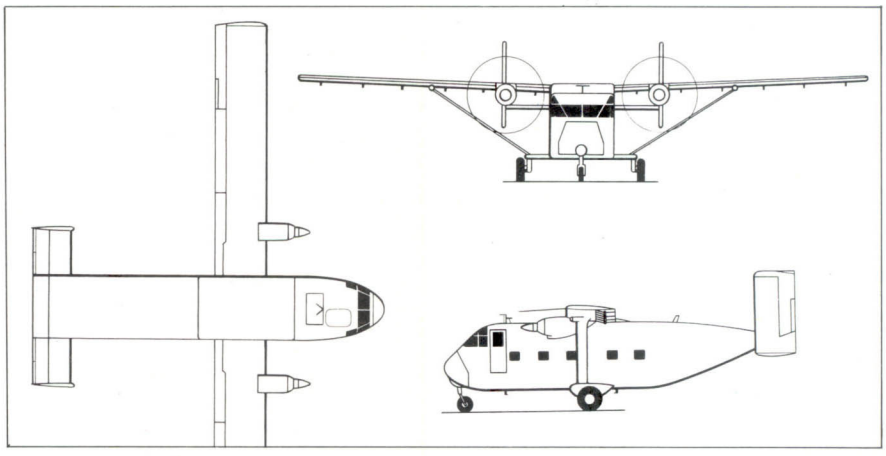


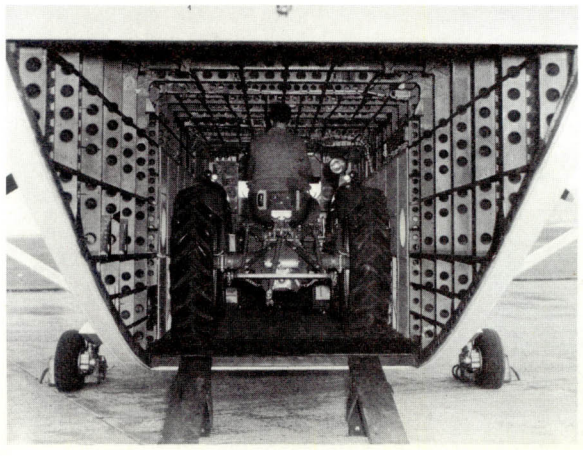
THE Skyvan project was based on F G Miles' experience with the HDM.105, an Aerovan IV fitted experimentally with an all-metal high-aspect-ratio Hurel Dubois wing of 23 m (75 ft 4 in) span. Shorts acquired the design and trials data but did not pursue the project.

However, Shorts did recognize the concept of a flying boxcar and designed a utility aircraft to carry 15 passengers or 1360 kg (3000 lb) of freight, powered by two 390-hp Continental GS10-520 turbo-supercharged piston engines. The cross-section of the fuselage interior was 1.98 m (6 ft 6 in) square and 5 m (16 ft 6 in) long, and its large rear loading door could be opened in flight. The first flight was in January 1963, but very soon the engines were replaced by two 520-ehp Turboméca Astazou II turboprops, this version first flying in October 1963. Eighteen months later saw the fitting of more powerful Astazou Xs.

The introduction of the Mk 2 led to a number of changes: 730-ehp Astazou XIIs (to be replaced in the Mk 3 by Garrett-AiResearch TPE331s), more streamlined nose, single nosewheel, and larger, square cabin windows. From the ninth Mk 2 fuel capacity was increased from 795 to 1022 litres (175 to 225 Imp gal) and cabin length extended to 5.6 m (18 ft 7 in).

The Mk 3 flew in late 1967, having further increased fuel capacity, a reduced empty weight, and other detail changes. Twenty-two passengers could be accommodated (or up to 12 stretcher cases with two attendants), or 2086 kg (4600 lb) freight, including a small vehicle. A QC (quick change) version was developed to take up to 2000 kg (4400 lb) freight on four pallets, while lightweight passengers' seats fold against the cabin sidewall. Examples of the Mk 3 are in service as airborne workshops, survey aircraft, executive transports and in oil rig-related operations. A luxury version known as the Shorts Skyliner has been developed for commuter operators by third-level airlines, featuring 22 seats in a new interior which has individual passenger-service panels and a washroom. Weather radar and area navigation systems are fitted and a new, quiet version is fitted with low-speed engines driving four-bladed propellers. A military variant – the Skyvan 3M – has accommodation for up to 22 troops or 16 paratroops, or a conveyor system for paratrooping supplies.





Skyvan Srs 3

Type: light civil or military STOL utility transport
Maker: Short Brothers Ltd
Span: 19.79 m (64 ft 11 in)
Length: 12.21 m (40 ft 1 in)
Height: 4.6 m (15 ft 1 in)
Wing area: 34.65 m^2 (373 sq ft)
Weight: maximum 5670 kg (12 500 lb); empty 3331 kg (7344 lb)
Powerplant: two 715-hp Garrett-AiResearch TPE331-201 turboprops
Performance: maximum cruising speed 327 km/h (203 mph) at 3050 m (10 000 ft); range 1115 km (694 miles)
Payload: 2086 kg (4600 lb); seats for up to 19 passengers
Crew: 1 to 2
Production: minimum 100 by 1980

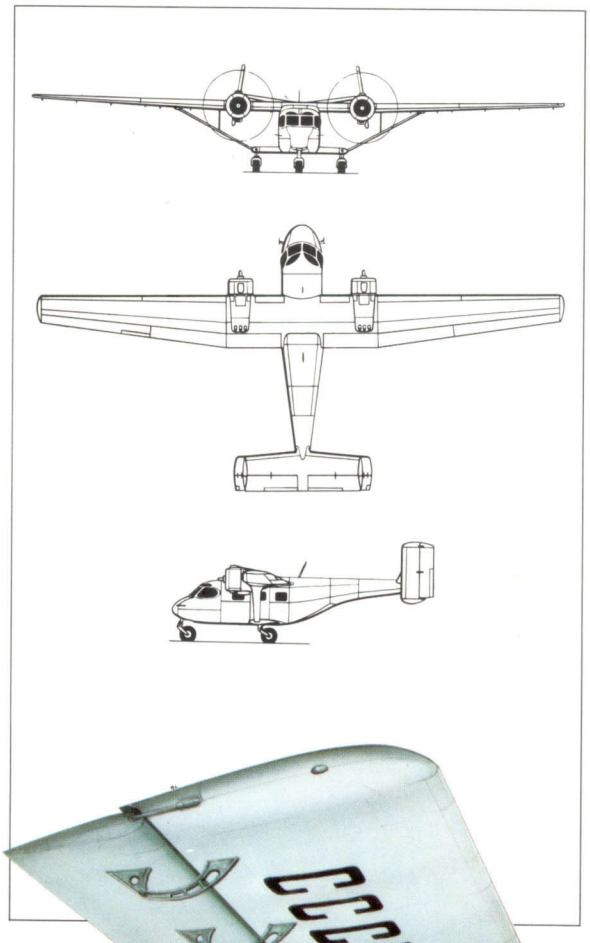
Top: A Short Skyvan of Summit Airlines. Summit operates seven Skyvans on all-cargo services in the eastern US
Above left: A Skyvan in the colours of Ansett-MAL during a demonstration flight before delivery in September 1966
Left: A Ferguson tractor in the hold of a Skyvan

An-14, Antonov

FIRST FLIGHT 1958

THE Antonov An-14 Pchelka (Little Bee) was originally designed to meet a requirement for a small utility aircraft for Aeroflot, the Soviet air transport organization. Although somewhat larger than the lighter, lower-powered Britten-Norman Islander, the An-14 has a much shorter range and accommodates fewer passengers. The specification called for higher-standard seating than the widely used An-2, but for a similar STOL (short take-off and landing) performance. The initial flight by the prototype took place on March 15, 1958, the first two aircraft being powered by 260-hp Ivchenko AI-14R radial engines. Development of the type saw the introduction of dihedral on the tailplane, while the leading edge of each tailfin was modified to provide greater surface area from new rectangular fins. Two 300-hp AI-14RF nine-cylinder radials were substituted for the original powerplants, thus allowing the payload to be increased by one passenger. Performance was still not satisfactory, however, and the wing was subsequently redesigned with a span increased from just under 19.8 m (65 ft) to more than 22 m (72 ft). The original parallel chord was modified to produce a tapered section outboard of each engine. Full-span leading-edge slats and double-slotted flaps are now featured, and the fuselage has also been modified. All these changes delayed the type's entry into service, which did not occur until 1965.

The first production examples were delivered to Aeroflot as Antonov An-14As, identified in the West by the NATO codename Clod. Like the earlier An-2, the Little Bee was intended for several uses: cargo carrier, air ambulance (carrying six stretcher units and a medical attendant), aerial photography and geological surveying. The agricultural variant has a 1000-litre (220-Imp gal) chemical tank within the fuselage, and spraying bars fitted beneath the wings and along each bracing strut; skis and floats may also be fitted. Passengers enter the cabin through a pair of clamshell doors which form the underside of the upswept rear fuselage. A military version was first revealed at the Domodedovo Air Show in July 1967. This version serves with the Soviet air force, and the armed forces of Bulgaria, the German Democratic Republic and Guinea. Production of the An-14 has been centred at the Progress Plant at Arsenyev which is situated in the far east of the Soviet Union.



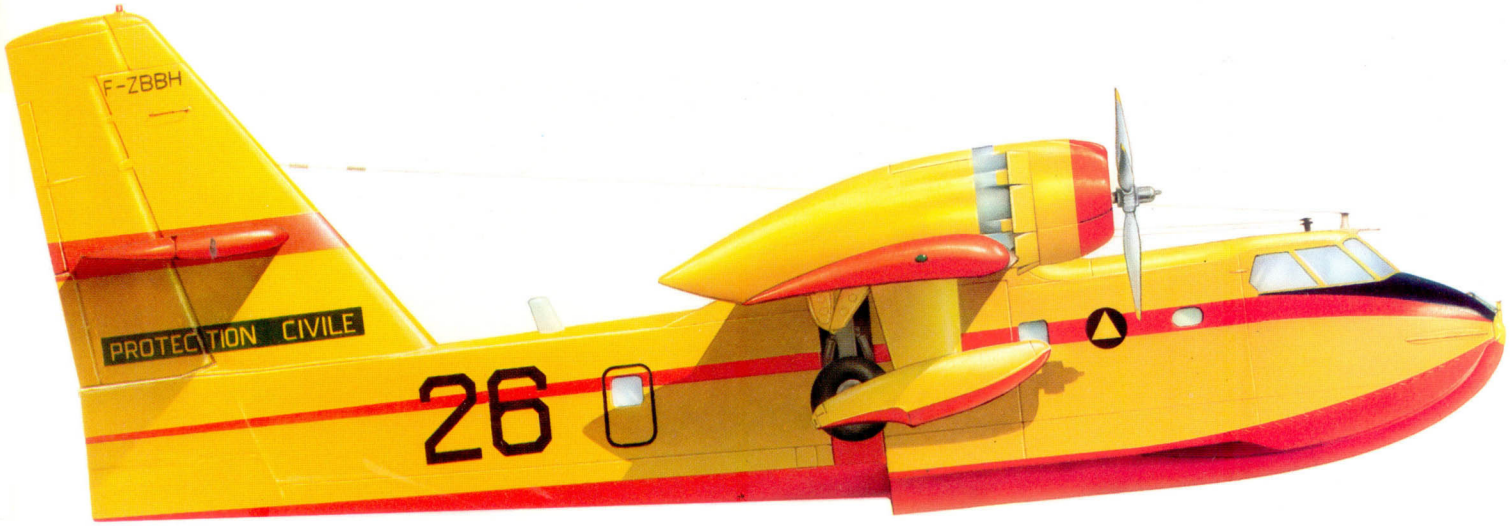
An-14

Type: light general-purpose aircraft
Maker: Antonov Design Bureau
Span: 21.99 m (72 ft 2 in)
Length: 11.44 m (37 ft 6½ in)
Height: 4.63 m (15 ft 2½ in)
Wing area: 39.72 m² (427.5 sq ft)
Weight: maximum 3600 kg (7935 lb); empty 2000 kg (4409 lb)
Powerplant: two Ivchenko AI-14RF 9-cylinder air-cooled radial engines
Performance: maximum speed 222 km/h (138 mph) at 1000 m (3280 ft); range 800 km (497 miles)
Payload: 720 kg (1590 lb); seats for up to 8 passengers
Crew: 1
Production: minimum 300

Top: An Antonov An-14. Though it is in Aeroflot livery, there are military-style markings on the tail
Below: The An-14 is known as the Pchelka (Little Bee). Passengers enter through clamshell doors in the rear and the high tailplane allows quick loading – essential in the ambulance version

CL-215, Canadair

FIRST FLIGHT 1967



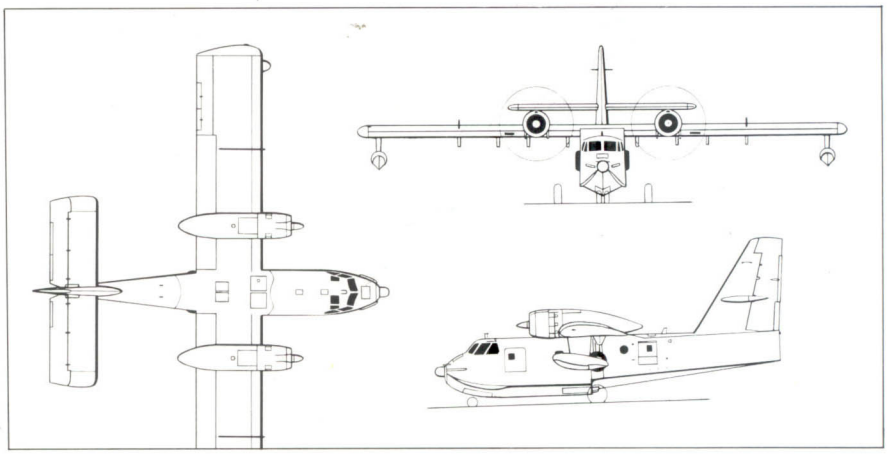
THE Canadair CL-215 is almost unique in having been designed to do a job which traditionally was only done by aged examples of older military and civil types, specially adopted and modified for the role.

The primary duty of the CL-215 is that of aerial fireman. Canadair designed this twin-engined amphibian from the outset for simplicity of operation and maintenance; it can operate from very small airstrips, from lakes, open bays, and can also be adapted for other roles. First flight was made in October 1967, with the first take-off from water occurring on May 2, 1968.

The governments of France, Canada, Spain and Greece all operate the aircraft in the fire-fighting role. Three different methods of fighting grass, bush or forest fire are offered by the CL-215: plain water lifted from any 1.2-km (¾-mile) stretch of water, or short-term fire retardants mixed with water during the scooping operation, or a load of long-term retardant, pre-mixed and loaded on the ground at a land base. A maximum load of 5455 litres (1200 Imp gal) may be carried, and the two tanks (in the fuselage) can be filled in 90 sec or, while skimming the water at 111 km/h (69 mph), in 16 to 20 sec. The original scooping system was improved to reduce this time to ten sec. Wave heights of up to 2 m (6 ft) have been successfully overcome in French operations in the Mediterranean, and on many occasions CL-215s have performed more than 100 pickups in a single day's fire-fighting. This amounts to a total lift in excess of 550 000 litres (120 000 Imp gal) of water.

A system for onboard mixing of long-term retardants has been developed, which can produce 21 000 litres (4600 Imp gal) in one flight. Tests have shown that a foam mixture can be used to fight oil fires, while in Canada, the province of Quebec converted a number of aircraft, in a huge campaign begun in 1973, for use as crop-sprayers in an effort to protect large areas of woodland and forest against the budworm.

In other operations the CL-215 can accommodate 15 passengers, (19 if header tanks are removed) or nine stretchers in the casualty evacuation role. As a search-and-rescue aircraft the CL-215 has stations for navigator, flight-engineer and two observers, with room for four seats or six stretchers as well.



CL-215

Type: multi-role amphibian
Maker: Canadair Ltd
Span: 28.6 m (93 ft 10 in)
Length: 19.82 m (65 ft 0½ in)
Height: 8.92 m (29 ft 3 in)
Wing area: 100.33 m² (1080 sq ft)
Weight: maximum 19 731 kg (43 500 lb); empty 12 065 kg (26 600 lb)
Powerplant: two 2100-hp Pratt & Whitney R-2800-83AM2AH 18-cylinder radial engines
Performance: maximum cruising speed 291 km/h (181 mph) at 3050 m (10 000 ft); range with 1587 kg (3500 lb) payload 1853 km (1151 miles)
Payload: 2805 kg (6185 lb) as utility aircraft and 5443 kg (12 000 lb) as water bomber; seats for up to 19 passengers
Crew: 2
Production: 80 by 1980

Top: A French Canadair CL-215; the type has proved highly successful fighting fires in Southern France, where some aircraft have made more than 100 water pickups in one day's work
Left: A Canadian CL-215 dumps its 5443-kg (12 000-lb) payload over a forest fire

Westwind, IAI

FIRST FLIGHT 1963

Left: A Canadian-registered Jet Commander which was the basis for the Westwind Below: The Westwind II showing its wingtip tanks with their characteristic Whitcomb winglets which improve cruise performance. The Westwind has been widely sold as both a maritime-surveillance aircraft and business jet

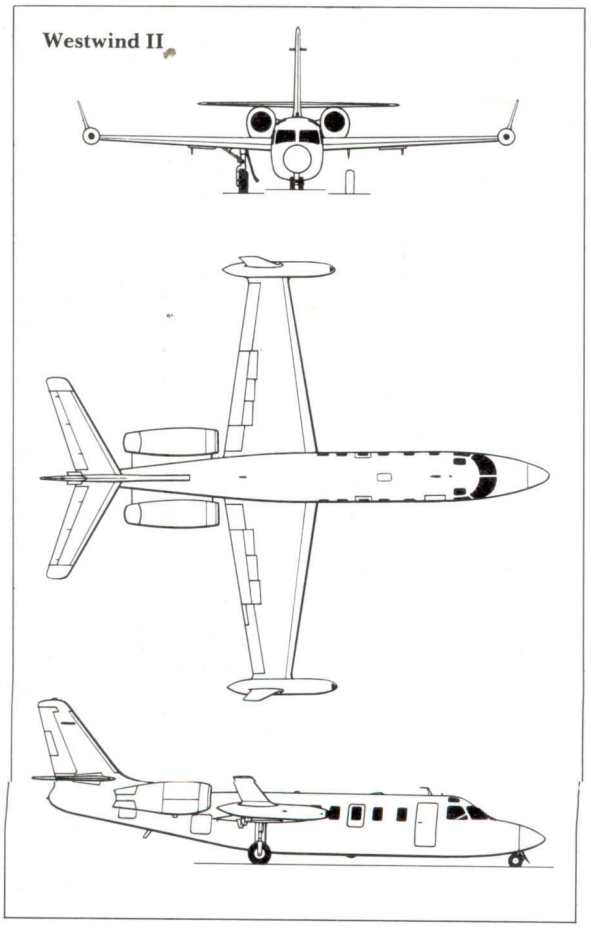
ISRAEL Aircraft Industries' Westwind business jet may be traced back to the American Aero Commander Model 1121 Jet Commander which was designed by Ted Smith and first flew in January 1963. When Aero Commander merged with North American Rockwell they were obliged to sell off the Jet Commander to avoid conflict with US antitrust laws (the parent company was already marketing the Sabreliner business jet).

Israel Aircraft Industries bought the entire Jet Commander programme and all production tooling and sales rights, and after refining the design returned it to the market as the 1123 Commodore Jet, later renamed the 1123 Westwind. The Westwind had a lengthened fuselage, more powerful engines and tiptanks. The longer fuselage could accommodate up to ten passengers. The first Israel-built Westwind 1123 flew on September 28, 1970 and 36 had been delivered when production ceased in mid 1976 in favour of the Model 1124 which was re-engined with fuel-efficient Garrett-AiResearch TFE731 turbofans in place of the pure turbojets used in all previous models.

The first Model 1124 Westwind flew on July 21, 1975 since when production of the aircraft, known as Westwind I, has been running at three to four per month to meet heavy demand from United States business operators. The pressurized cabin can accommodate up to ten passengers with a flight crew of two. The interior arrangement can be altered to suit customer requirements. The cabin is heated, ventilated and air-conditioned. More than 90 have been delivered.

Three Model 1123 Westwinds were modified for maritime surveillance roles for the Israeli navy in 1977 and a maritime aircraft called the Westwind Sea Scan is today based on the 1124 airframe. It incorporates Litton LASR-2 search radar in a bulbous nose radome, Global Navigation's NS-500A VLF navigation system, forward-looking infrared scanner systems, low-light-level television cameras and monitors, magnetometers and sonobuoys, depth chargers or emergency-rescue equipment.

A further civil version called Westwind II is currently under development in Israel featuring drag-reducing Whitcomb winglets mounted atop the aircraft's tiptanks, which are expected to improve cruise performance by some 70 km/h (43 mph) and range by 560 km (348 miles).

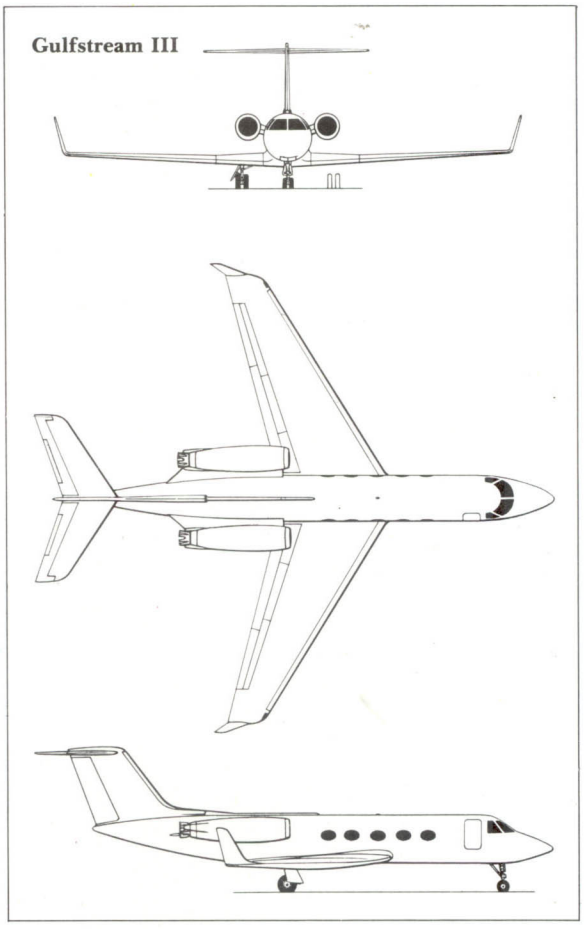


Westwind I

Type: business and corporate transport
Maker: Israel Aircraft Industries
Span: 13.65 m (44 ft 9½ in)
Length: 15.93 m (52 ft 3 in)
Height: 4.81 m (15 ft 9½ in)
Wing area: 28.64 m^2 (308 sq ft)
Weight: maximum 10 659 kg (23 500 lb); empty 5578 kg (12 300 lb)
Powerplant: two 1680-kg (3700-lb) st Garrett-AiResearch TFE731-3-1G turbofans
Performance: maximum speed 872 km/h (542 mph) at 5800 m (19 000 ft); range 4619 km (2870 miles)
Payload: seats for up to 10 passengers
Crew: 2
Production: minimum 170 by 1981

Gulfstream II,

FIRST FLIGHT 1966



Gulfstream II

Type: business and corporate transport
Maker: Gulfstream American Corporation
Span: 21.87 m (71 ft 9 in) with tiptanks
Length: 24.36 m (79 ft 11 in)
Height: 7.47 m (24 ft 6 in)
Wing area: 75.2 m^2 (810 sq ft)
Weight: maximum 29 711 kg (65 500 lb); empty 16 867 kg (37 186 lb)
Powerplant: two 5175-kg (11 400-lb) st Rolls-Royce Spey Mk 511-8 turbofans
Performance: maximum cruising speed 936 km/h (581 mph) at 7620 m (25 000 ft); range with reserves and tiptanks 6880 km (4275 miles)
Payload: seats for up to 19 passengers
Crew: 2
Production: 256 (II only)

DESPITE the fact that it shares a common name with its turboprop predecessor, the Grumman Gulfstream II was a completely new design launched in May 1965. Of similar size to the Gulfstream I, with seating for ten in a typical executive interior and up to 19 in high-density layouts, the Gulfstream II was planned as an up-market business jet offering the performance and range of (and greater comfort than) intercontinental airline jet transports.

Unusually, no prototype was built, the first aircraft, which flew on October 2, 1966 from Grumman's Bethpage, Long Island, factory, having been manufactured from production tooling. It was certificated by the US Federal Aviation Administration on October 19, 1967 and the first customer deliveries began that December. With the Gulfstream II, non-stop transcontinental and intercontinental flights became possible, and significantly about 97% of all G-IIs have been sold to major international companies.

The first 82 Gulfstream IIs built had a lower gross weight (26 080 kg [57 500 lb]) than current models, and after 166 had been built the Rolls-Royce Spey turbofan engines were fitted with acoustic hush-kits to meet more stringent environmental regulations. In 1975 Grumman began a protracted test and certification programme for the installation of wingtip tanks which increased fuel capacity by 1415 kg (3120 lb) and improved the range by 14%.

In 1977 Grumman announced plans for a stretched Gulfstream III which would incorporate a number of aerodynamic improvements including an entirely new wing of supercritical airfoil. Forty customer deposits were received when, six months later, Grumman announced that the project had been cancelled as too expensive to develop. However, following the acquisition of production rights and tooling by the Gulfstream American Corporation, the Gulfstream III has been revived. The fuselage has been stretched and although an entirely new wing has not been developed, the existing surface has been greatly modified and incorporates drag-reducing Whitcomb winglets at the tips. The first Gulfstream III flew on December 2, 1979 and during 1980 this aircraft will replace the Gulfstream II on the Savannah, Georgia, production line. Forty aircraft had been sold by 1980.

Top left: The Rolls-Royce Spey turbofans of the Gulfstream II. Aircraft after number 166 have been fitted with acoustic hush-kits to conform with noise regulations to be introduced in the mid 1980s
Above: The Gulfstream II was designed to give the performance of intercontinental airline jets but with the comfort of an executive interior

Bandeirante, Embraer

FIRST FLIGHT 1968

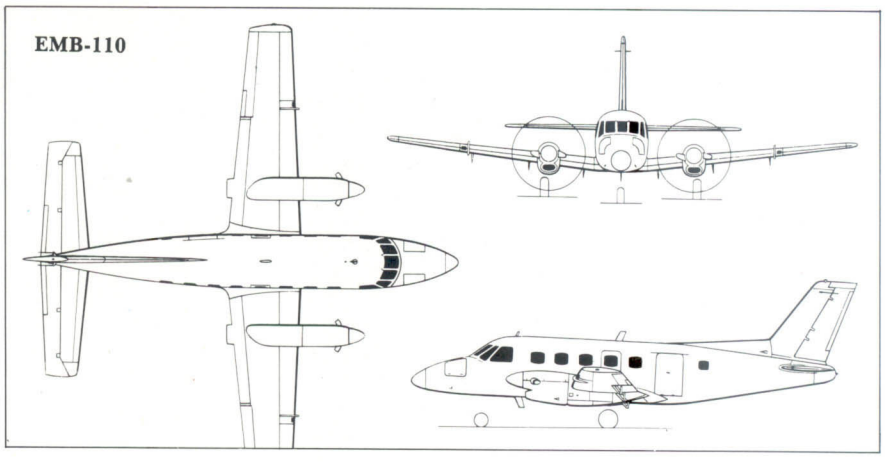
EMBRAER, formed to promote the development of the Brazilian aircraft industry, came into being in late 1969, but the Bandeirante (Pioneer) had been conceived before then. The Brazilian Ministry of Aeronautics' specification had called for a general-purpose twin-turboprop light transport capable of carrying out missions such as navigation training, general transport and aeromedical evacuation.

There are nine versions of the Bandeirante, with two fuselage lengths and two engine sizes. The standard 15-passenger commercial transport version is the EMB-110C, operated by Transbrasil, the Chilean navy and Uruguayan air force. The EMB-110B is a special version operated by the Brazilian air force for aerial photography with an electrically-operated ventral sliding door, Doppler navigation system and crew of three equipment operators.

The executive transport version is the EMB-110E(J), with accommodation for seven passengers, four in individual seats and three on a sideways-facing sofa. Other luxuries include a galley, wardrobe, and stereo radio and tape-deck facilities. The EMB-110K1 is an all-cargo version, lengthened by a 0.85-m (2 ft 9½-in) plug between the flight-deck and centre fuselage. This is available as a quick-change version for passenger or cargo work and is designated EMB-110P1. Twenty of the cargo version are in service with the Brazilian air force under the designation C-95.

The EMB-110P is a commercial third-level commuter version for 18 passengers. A further passenger development of the long-fuselage Bandeirante is the EMB-110P2, which carries up to 21 passengers. It is powered by two 750-shp Pratt & Whitney Aircraft of Canada PT6A-34 turboprop engines and is fitted with four integral fuel tanks in the wings. These are in service by, or destined for, Air Littoral, Talair (Niugini), Masling Commuter Air Services (Australia), Air Wales, Brittany Air International, Fairflight Charters and Air Sudan.

Other Bandeirantes are the EMB-110S1 for geophysical survey work, and the EMB-111 maritime patrol version, which first flew on August 15, 1977. It is in service with the Brazilian air force and the Chilean navy. Those supplied to the Chilean navy are equipped with a full de-icing system and passive ECM antennae.



EMB-110P2

Type: general-purpose transport
Maker: Empresa Brasileira de Aeronáutica
Span: 15.32 m (50 ft 3¼ in)
Length: 15.1 m (49 ft 6½ in)
Height: 4.92 m (16 ft 1¾ in)
Wing area: 29.1 m² (313.23 sq ft)
Weight: maximum 5670 kg (12 500 lb); empty 3516 kg (7751 lb)
Powerplant: two 750-hp Pratt & Whitney PT6A-34 turboprops
Performance: maximum speed 460 km/h (286 mph) at 2440 m (8000 ft); range 1900 km (1180 miles)
Payload: 1681 kg (3706 lb); seats for up to 21 passengers
Crew: 2
Production: 270 (all versions) by early 1980

Left: The Bandeirante (Pioneer) with Brazilian registration and Mountain West livery. This is a popular third-level airline machine which comes in two lengths and with two sizes of engine. Like many general aviation aircraft it is also used by the armed forces of some smaller nations

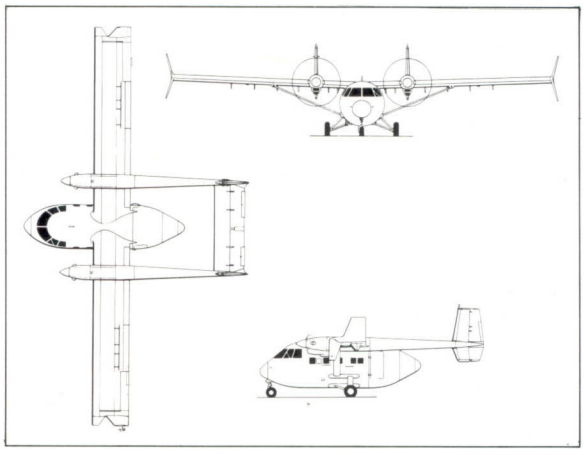
Arava, IAI

FIRST FLIGHT 1969

DESIGN work on a light STOL (short take-off and landing) civil and military transport aircraft began at Israel Aircraft Industries in 1966. The aircraft was to have full rough-field performance capabilities, and for ease of loading a twin-boom layout with rear cargo doors was chosen. The first prototype IAI 101 Arava flew for the first time on November 27, 1969; a second aircraft followed on May 8, 1971 and the production civil version, IAI 101, was type certificated in April 1972.

A military derivative designated IAI 201 flew in prototype form on March 7, 1972. The commercial Arava can carry up to 20 passengers, while the IAI 201 can accommodate 24 fully equipped military personnel, or 17 paratroops, or 12 stretcher cases together with two medical attendants. The rear fuselage swings open to make loading easier. The military Arava can be armed with two side-mounted rocket pods which contain seven 68-mm (2.67-in) rockets each and a forward firing 12.7-mm (0.50-in) Browning machine-gun either side of the fuselage in addition to a rear-firing machine-gun.

Three Aravas were leased to the Israeli air force for operational trials during the Yom Kippur war, but principal customer interest has come from Third World air forces. Aravas are currently in service with the air arms of Bolivia, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, and El Salvador, in addition to the Israeli air force which has taken 14 of the 60-plus Aravas built for liaison duties.



The latest development of the Arava is the IAI-202, distinguished from previous models by its increased length, the drag-reducing Whitcomb winglets which were mounted at the wingtips and a boundary layer fence just inboard of each tip. This modification is available as a retrofit on other Arava aircraft. It is powered by a pair of 750-shp Pratt & Whitney Aircraft of Canada PT6A-36 turboprops and fuel is accommodated in two integral tanks in each wing with optional cabin-mounted fuel tanks.

The interior accommodation can be adapted to suit the intended specialist role of the aircraft. The tail unit is a cantilever light alloy structure with twin fins and rudders attached to twin booms which extend aft from the engine nacelles.

IAI 201 Arava

Type: STOL utility aircraft
Maker: Israel Aircraft Industries
Span: 20.96 m (68 ft 9 in)
Length: 13.03 m (42 ft 9 in)
Height: 5.21 m (17 ft 1 in)
Wing area: 43.68 m^2 (470 sq ft)
Weight: maximum 6803 kg (15 000 lb); empty 3998 kg (8816 lb)
Powerplant: two 750-shp Pratt & Whitney of Canada PT6A-34 turboprops
Performance: maximum speed 326 km/h (203 mph) at 3048 m (10 000 ft); range with maximum fuel and 45 min reserves 1306 km (812 miles)
Payload: 2351 kg (5184 lb); seats for up to 24 passengers
Crew: 1 to 2
Production: 129 by 1980

Below: The IAI Arava 202 which is recognizable by its Whitcomb winglets and boundary-layer fence inboard of each tip. Military types carry a variety of loads including paratroops, cargo and even external weapons pods

Pawnee, Piper

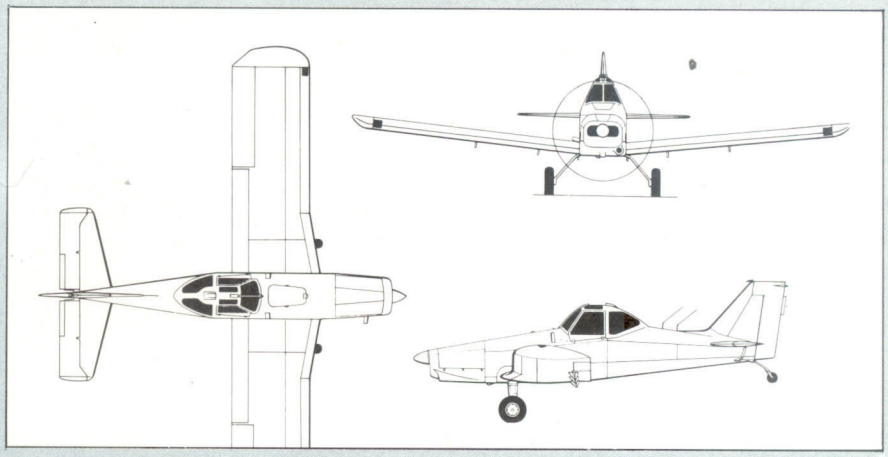
FIRST FLIGHT 1959

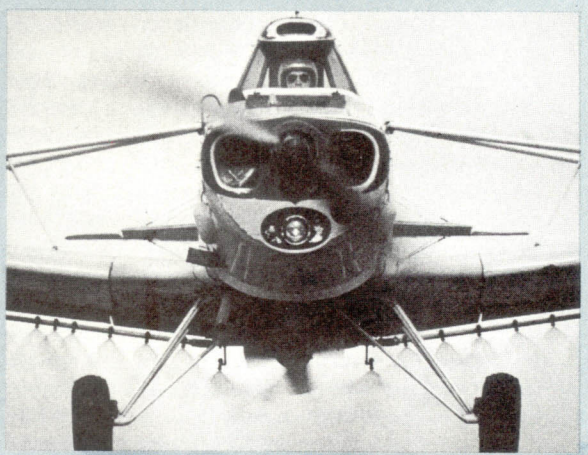
THE PA-25 Pawnee agricultural aircraft was designed for Piper Aircraft Corporation in the late 1950s by consultant designer engineer Fred Weick, who had previously designed the Erco 415 Ercoupe light plane, and the Transland agricultural aircraft at Texas A & M University. Weick's intention was to produce an aircraft which would dramatically reduce pilot fatalities from the low-speed crashes which are common in crop-dusting operations. He designed a hump-backed fuselage in which the pilot sat high up, giving good all-round vision and providing a deep under-cockpit floor to absorb vertical impact. The forward structure was designed to collapse progressively while the cockpit layout was designed so as to minimize injury in a crash and not collapse if the aircraft turned over. The Pawnee's wings came from the Piper Super Cub and were braced by overhead struts. When the Pawnee entered production at Lock Haven, Pennsylvania in 1959, it revolutionized the agricultural aviation business, which hitherto had been served largely by converted military Stearman biplanes and Piper Cubs.

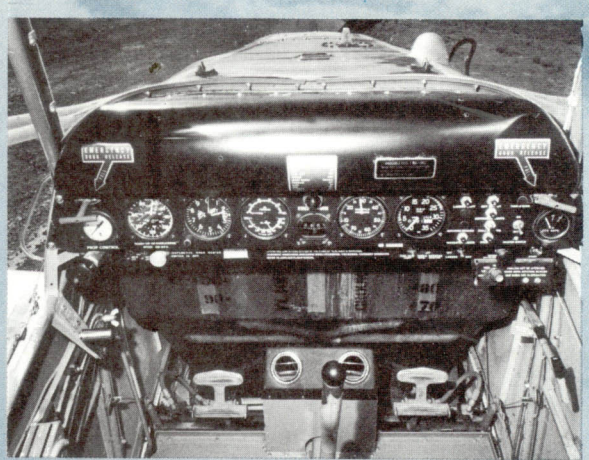
The first Pawnees were powered by 150-hp Lycoming O-320 engines, since replaced with a 235-hp Lycoming O-540-E engine. This model remains in production as the Pawnee D; a 260-hp variant with a payload of 544 kg (1200 lb) of chemicals and an optional second seat for mechanic/loader/trainee pilot is also available.

In 1972 a new Pawnee designated PA-36 and named Brave was introduced. It was an almost entirely different airframe, with metal skinning replacing the fabric covering of the earlier models, a new cantilever wing, new tail surfaces and a choice of 285-hp Continental Tiara or 375-hp Lycoming IO-720-D1CD engines. The Tiara-engined variant proved troublesome in operation and has since been dropped in favour of a conventional 300-hp Lycoming engine. From 1978 the Pawnee was called Brave 300 or 375.

Some 5000 Pawnees of all models have been built by Piper and under licence in Argentina. Among claims made by the manufacturer for the aircraft is the doubling of Ghana's cocoa crop, the creation of the first ever corn crop on the Florida peninsula by effective pest-suppression, and the saving of over $3½ billion in crop losses per year in the United States alone. The Pawnee has been exported to more than 90 countries worldwide.



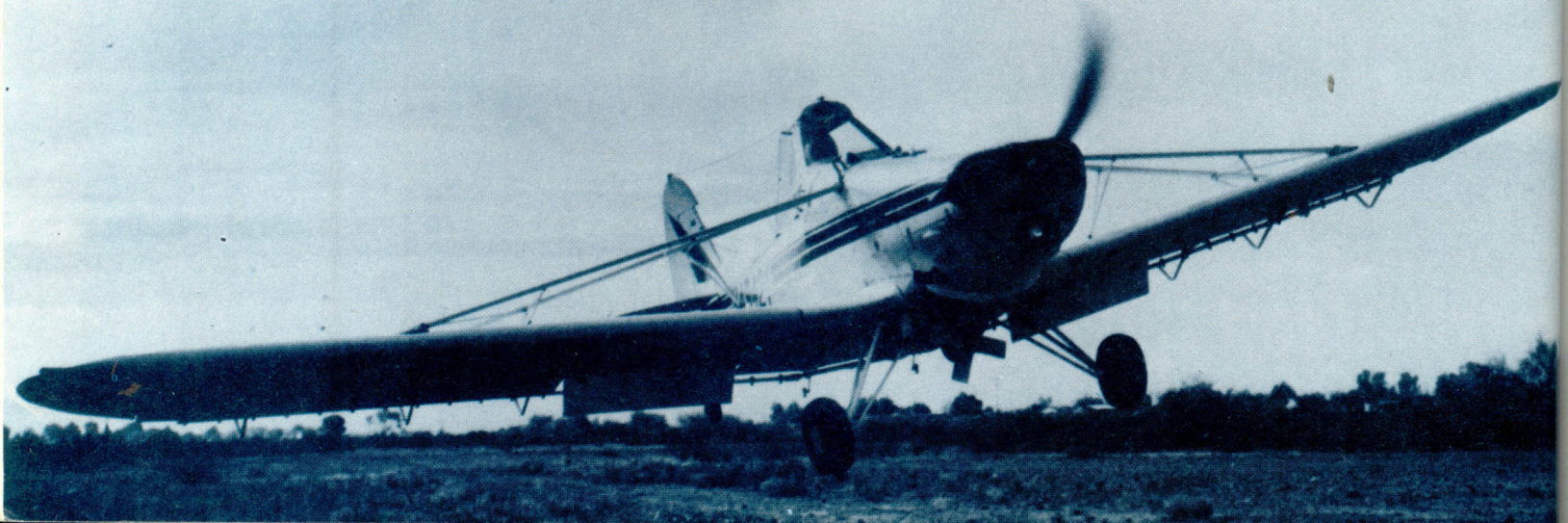




PA-36 Brave 375

Type: single-seat agricultural aircraft
Maker: Piper Aircraft Corporation; Chincul SA, Argentina
Span: 11.82 m (38 ft 9 in)
Length: 8.38 m (27 ft 6 in)
Height: 2.29 m (7 ft 6 in)
Wing area: 20.96 m^2 (225.65 sq ft)
Weight: maximum 2177 kg (4800 lb); empty 1104 kg (2434 lb)
Powerplant: one 375-hp Avco Lycoming IO-720-D1CD 8-cylinder piston engine
Performance: maximum speed 257 km/h (160 mph); range with reserves 861 km (535 miles)
Payload: dry chemical spraying equipment, maximum capacity 862 kg (1900 lb)
Crew: 1
Production: minimum 5000 up to 1980

Above left: A haze of spray hangs behind a Piper Pawnee
Left: The simple cockpit with a minimum of instruments, which include an airspeed indicator, rev counter, compass and fuel gauge
Below: A Pawnee skims a crude landing strip



Thrush Commander, Ayres

FIRST FLIGHT 1968

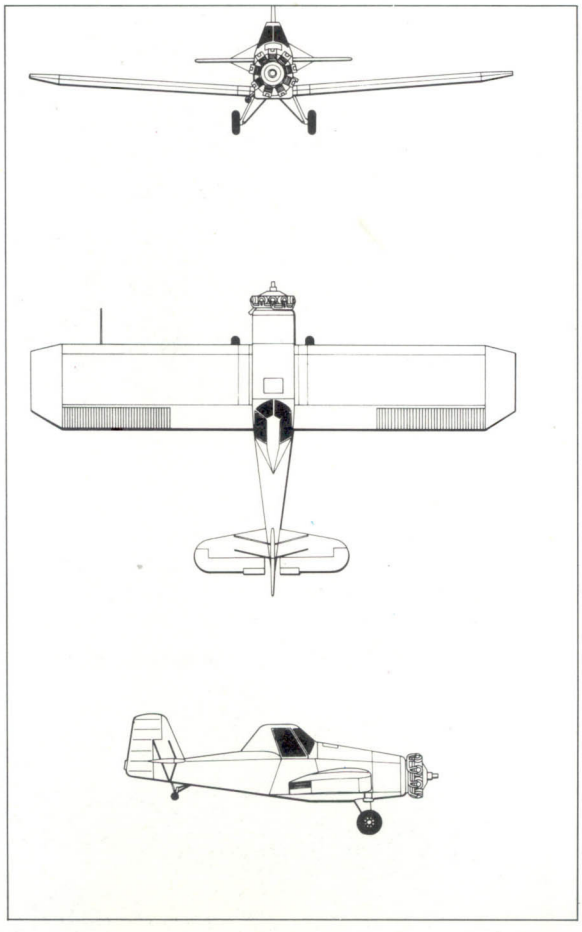
THE Snow S-2A, designed by Leland Snow in 1958, was offered with 220-hp Continental (S-2A), 450-hp Pratt & Whitney (S-2B), and 600-hp Pratt & Whitney (S-2D) radials.

In 1965 Snow sold the manufacturing rights to Aero Commander Inc of Bethany, Oklahoma, who renamed it Ag Commander S-2D. Two years later when Aero Commander became part of North American Rockwell, the design was further developed with a fully-enclosed cockpit, electric flaps and an enlarged 1818-litre (400-Imp gal) chemical hopper and marketed as the S-2R Thrush Commander from a production line at Albany, Georgia.

The Thrush Commander proved popular with crop-dusting and spraying operators, and also for aerial seeding, fertilizing and even water-bombing. Its robust structure was carefully designed to absorb energy on impact and thus protect the pilot from serious injury in a crash, and the ease of access to its corrosion-proofed tubular fuselage structure via quick-release side panels greatly facilitated cleaning chemical deposits from the airframe.

In 1977 Rockwell International disposed of the Thrush Commander type certificate and all production facilities to Frederick Ayres of Ayres Corporation, who continued production at Albany while working on a number of improvements to the basic design. Among these was a trial installation of a 750-shp Pratt & Whitney of Canada PT6A turboprop engine which was aimed both at reducing operating costs and solving the increasingly difficult problem of obtaining spares for the radial piston engines powering all previous Snow/Commander/Thrush models. The PT6-powered Turbo Thrush (known in the business as the 'Hush Thrush' because of its quietness compared to the radials) is now in full production at Albany alongside the standard S-2R Thrush 600 and 800 which are offered with either Pratt & Whitney or Polish Pezetel 3S 600-hp powerplants or an 800-hp Wright Cyclone. The Turbo Thrush also incorporates a larger 2273-litre (500-Imp gal) chemical hopper, and for pilot comfort all current production models offer optional air conditioning and even stereo cassette decks. A two-seat Thrush has been developed to enable a mechanic/flagman to be ferried to working sites or to permit dual instruction for trainee Ag pilots. Parts of the cabin and the outer wings of the Thrush were used for the PZL M-18 Dromader.

Above: The Turbo Thrush, known as the 'Hush Thrush' because of its quiet engine, is powered by a Pratt & Whitney PT6A. The aircraft shown here is operated by AG Aviation (UK) Ltd
Left: The earlier radial-engined thrush: powerplants included 220-hp, 450-hp and 600-hp, but now it is becoming harder to find spares for these engines and the turboprop version is more popular



Thrush 600

Type: single-seat agricultural aircraft
Maker: Snow Aeronautical Corporation; Rockwell International; Ayres Corporation
Span: 13.51 m (44 ft 4 in)
Length: 8.95 m (29 ft 4½ in)
Height: 2.79 m (9 ft 2 in)
Wing area: 30.34 m^2 (327 sq ft)
Weight: maximum 3130 kg (6900 lb); empty 1678 kg (3700 lb)
Powerplant: one 600-hp Pratt & Whitney R-1340 Wasp 9-cylinder radial engine
Performance: maximum cruising speed 200 km/h (124 mph); range 648 km (403 miles)
Payload: chemical spraying equipment, capacity 1514 litres (333 Imp gal) or 1487 kg (3280 lb)
Crew: 1
Production: not available

Airtruk, Transavia

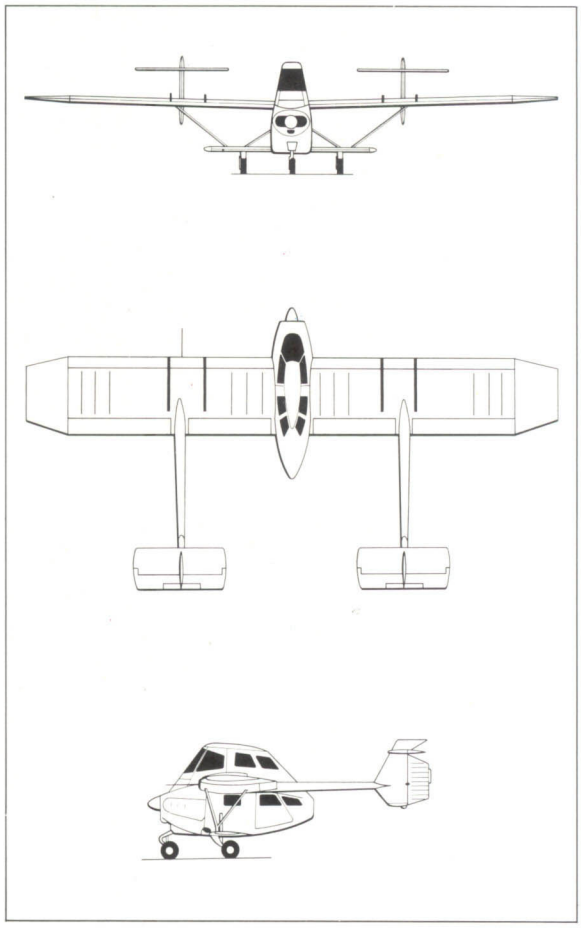
FIRST FLIGHT 1965

ONE of the world's strangest looking aircraft, the Transavia Airtruk was designed by Luigi Pellarini specifically to meet the special needs of agricultural operators in Australasia. He opted for a most unorthodox configuration, choosing to place the main fuselage containing the engine and chemical hoppers below the pilot's position, and to facilitate loading, mounted two separate fins and tailplane halves on twin booms with a wide gap between, so that a truck might be backed right up to the loading area. The tail units are mounted on twin cantilever tubular Alclad booms extending backwards from the upper wing. The smaller stub wings, situated below the fuselage, are braced to the cabin by a single strut and to the upper wings by a V strut on each side.

The first Airtruk flew on April 22, 1965, powered by a 300-hp Continental IO-520-D engine, and was put into production by Transavia at Bankstown, New South Wales, Australia, in 1966 as the Model PL-12. In December 1970 a utility passenger/cargo model designated PL-12U was first flown. This model is externally similar to the agricultural Airtruk, except for accommodation. By removing the central chemical hopper from the fuselage, space has been created for a single passenger sitting back-to-back with the pilot and four more passengers on the lower fuselage deck. It is powered by a 300-hp Rolls-Royce Continental IO-520-D flat-six engine which drives a McCauley D2A34C58/90AT-2 two-blade constant-speed metal propeller with spinner. The PL-12U is also available in cargo, air ambulance and aerial-survey layouts.

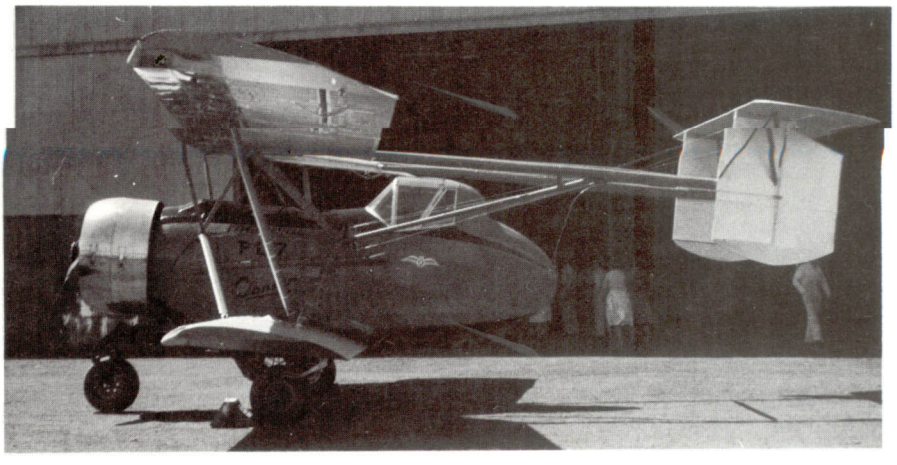
A 300-hp Lycoming IO-540-K1AS-engined version of the Airtruk has also been developed and is known as the Model T-300 Skyfarmer. In January 1976 the T-320 was certificated with a 325-hp Continental Tiara 6-320-2B engine in place of the standard Rolls-Royce-built Continental powerplant. The Tiara-engined Airtruk cruises some 32 km/h (20 mph) faster than the PL-12 model, and entered production in October 1976.

All models of the Airtruk are also assembled in New Zealand by Flight Engineers Limited from Transavia-manufactured components. Nearly 100 Airtruks of all models have been built, of which 18 are operating in Australia and 22 in New Zealand. The rest were exported to Denmark, India, Malaysia, East and South Africa and Thailand.



PL-12 Airtruk

Type: agricultural and utility aircraft
Maker: Transavia Corporation Pty Ltd; Flight Engineers Ltd
Span: 11.98 m (39 ft 3½ in)
Length: 6.35 m (20 ft 10 in)
Height: 2.79 m (9 ft 2 in)
Wing area: 23.8 m^2 (256 sq ft)
Weight: maximum 1855 kg (4090 lb); empty 839 kg (1850 lb)
Powerplant: one 300-hp Rolls-Royce Continental IO-520-D flat-six engine
Performance: maximum cruising speed 175 km/h (109 mph); range 531 km (330 miles)
Payload: seats for 2 passengers
Crew: 1
Production: minimum 100 (of all models by 1980)



Above: The experimental PL-7; the designer Luigi Pellarini developed the unusual tailplane to facilitate quick loading for chemical hoppers
Left: The PL-12 Airtruk; despite its looks, it has proved to be a popular and efficient aircraft and has been exported to Africa, the Far East and Denmark

Air Tractor AT-301

FIRST FLIGHT 1973

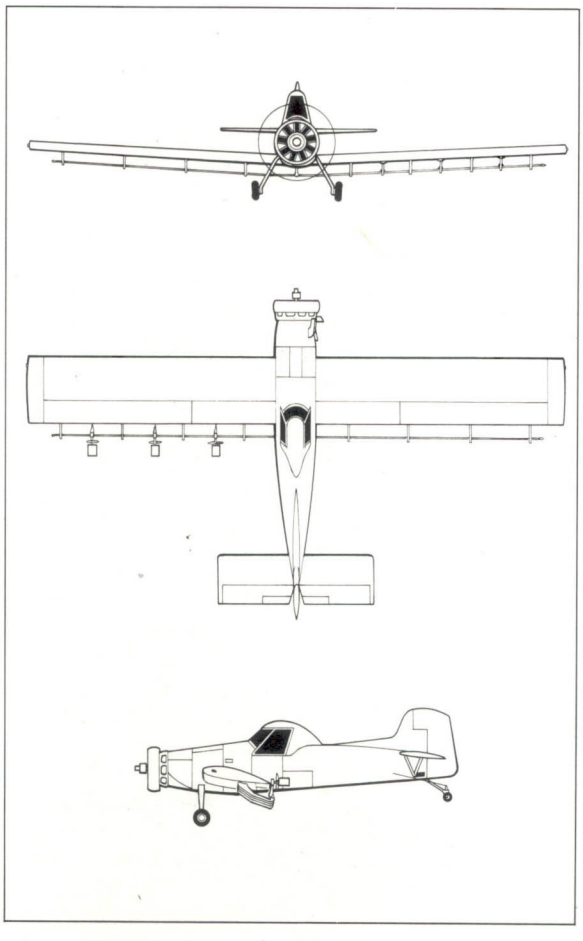
Left: The prototype Air Tractor at Rio Hondo, Texas, in 1974. Leland Snow included overlapped sealed joints in the wings to prevent chemical seapage, and a sealed air-conditioned cockpit Below: An Air Tractor at an aviation display at Harlingen, Texas, in October 1979

THE Air Tractor design dates from Texas crop-duster pilot and aeronautical engineer Leland Snow's 1958 Snow S-2A agplane. The latter series of aircraft became known as the Rockwell S-2R Thrush. Having disposed of the manufacturing rights to the Snow, the designer began work in January 1971 on a new aircraft designated Air Tractor AT-301. Construction of the prototype began in August 1972, first flight was from Olney, Texas in September 1973, and it was certificated by the US FAA within two months.

Like its predecessor the Air Tractor is a single-engine low-wing agricultural aircraft. The fuselage is constructed of welded steel tube and covered with quick-release skinning to provide easy access to the internal structure for maintenance and cleaning. The metal wing skins are sealed at joints and overlap to prevent chemical seepage, and the single-place cockpit is sealed and air-conditioned against noxious fumes. Chemicals are carried in a 1211-litre (266-Imp gal) glassfibre hopper forward of the raised cockpit area. The AT-301 is powered by one 600-hp Pratt & Whitney R-1340 air-cooled radial piston engine, which drives a Hamilton Standard two-blade metal constant-speed propeller type 12D40. Fuel is carried in two integral wing tanks which have a combined capacity of 288 litres (63.4 Imp gal). Some 200 Air Tractor AT-301s have been ordered and production at the Olney plant is running at about six aircraft per month.

Leland Snow began design studies on a turboprop-powered Air Tractor in September 1976, and the first production example, designated Model AT-302, flew in November of the following year. The basic airframe is similar to that of the radial-engined AT-301. The powerplant is a 600-shp Avco Lycoming LTP 101-600A turboprop which drives a Hartzell three-blade metal constant-speed propeller. This engine offers greater economy and longer times-between-overhaul than the piston engine and is relatively maintenance-free in field operations. An interesting point is the use of two large dry paper automobile-type air filters on the air intake to prevent chemicals being sucked in. The AT-302 is also in current production and 30 had been ordered by the beginning of 1979.

The AT-302A is similar to the AT-302 and first appeared in 1979. It is fitted with a 1457-litre (320-Imp gal) hopper with a 0.97-m (3 ft 2-in) wide gatebox for high application rates of dry chemicals.



AT-301

Type: agricultural aircraft
Maker: Air Tractor Inc
Span: 13.72 m (45 ft)
Length: 8.23 m (27 ft)
Height: 2.59 m (8 ft 6 in)
Wing area: 25.08 m^2 (270 sq ft)
Weight: maximum 3130 kg (6900 lb); empty 1633 kg (3600 lb)
Powerplant: one 600-hp Pratt & Whitney R-1340 Wasp radial piston engine
Performance: maximum cruising speed 241 km/h (150 mph); range 650 km (403 miles)
Payload: 1497 kg (3300 lb)
Crew: 1
Production: 244 ordered by 1979

Citation, Cessna

FIRST FLIGHT 1968

THE Cessna Citation has its origin in the Fanjet 500, an eight-seat executive jet that made its first flight in October 1968. Cessna subsequently changed the name to Citation, increased the gross weight and made several other changes which included a lengthened fuselage, a repositioning of the engine nacelles, larger fin and re-sited tailplane. The first production aircraft made its first flight in July 1971 and was granted FAA certification in September that year.

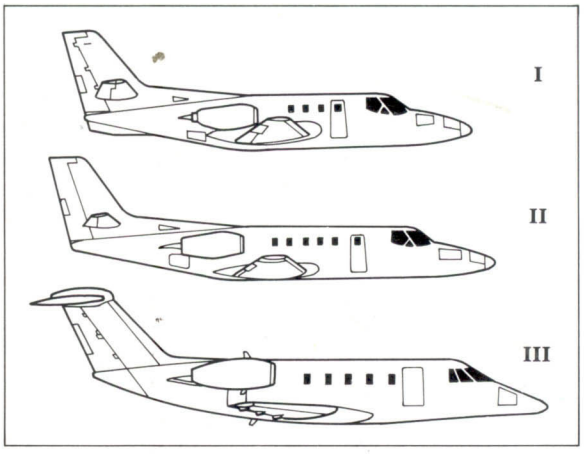
The early Series 500 Citation was designed to fly from relatively short runways only 762 m (2500 ft) long, and to use unpaved surfaces. It was also a fairly quiet aircraft for its type and size.

In 1972 it was certificated at a maximum weight (for take-off) of 4922 kg (10 850 lb) and later that year this weight was increased to 5216 kg (11 500 lb). New certification at that weight was granted early in 1973, and it was possible to modify earlier existing aircraft in order to operate at the increased weight.

A further increase in take-off weight was allowed by the FAA in 1976, together with optional thrust reversers. Later that year the Citation I was announced, with an increased span and JT15D-1A turbofans. This was certificated in December 1976, and subsequent aircraft were of this configuration. Basic passenger layout of the Citation I was for six seats (plus two pilots) although there were other special versions available.

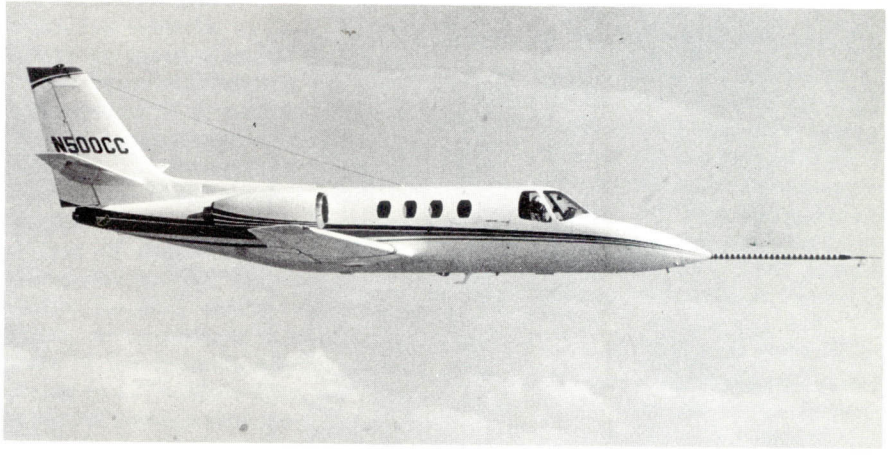
The Citation II was announced in 1976, with new features that included a fuselage lengthened by 1.14 m (3 ft 9 in), a wing with increased aspect ratio, and more fuel and baggage capacity. Pratt & Whitney JT15D-4s were the new choice of engine. The prototype was flown in early 1977 and certification was granted in 1978. The basic Citation II is a two-crew aircraft, but the Citation II/SP can be operated by one pilot at a weight of 5670 kg (12 500 lb).

The Citation III has some superficial resemblance to the earlier designs, but is really a completely new aircraft. Cessna wanted a larger passenger cabin and substantially faster cruise than the Citation II, and opted for one of the new supercritical aerofoil shapes for a good high-speed cruise at high altitude. As a result Citation III cruises at some 185 km/h (115 mph) faster than the straight-wing Citation II, but also handles well at



Above: A Cessna Citation 500 of Euralair. This aircraft was formerly registered N136CC and is one of two Citations operated by this Paris-based airline. Euralair flies to destinations in Europe and the North African coast
Left: Side elevations showing Citation variants

Left: A US-registered Citation II
Below: The prototype Citation with a striped instrumentation antenna in the nose. FAA certification has allowed a progressive increase in maximum take-off weights



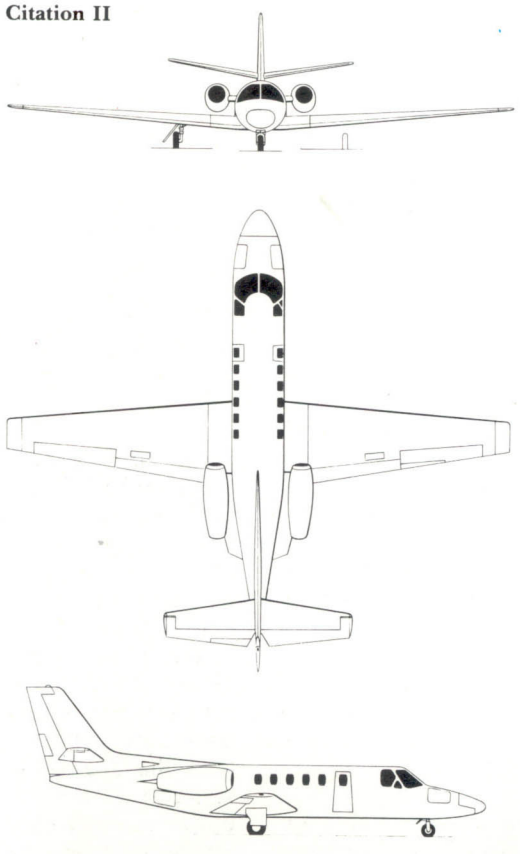
slow speeds, partly because of the small angle of sweepback and trailing-edge flaps.

The fuselage has a circular section similar to earlier Citations, but aisle height is up from 145 cm (57 in) to 178 cm (70 in) and the cabin is longer. Pressurization gives a cabin altitude of 2438 m (8000 ft) up to the operating ceiling of just over 15 548 m (51 000 ft). Although a conventional tail-plane was part of the original design, this was later changed to a T-tail, giving less drag at high speeds. The new engines are Garrett-AiResearch TFE731-3 turbofans, and an APU (auxiliary power unit) function is available on the right-hand engine to provide electrical power on the ground.

Citation III is designed for two-crew operation and will carry up to 13 passengers, although seating layouts for smaller numbers will probably be more common in service. Maximum take-off weight is 8830 kg (19 500 lb). A long-range version has a similar weight but about a third more fuel capacity, so that it will have a practical range of about 5550 km (3450 miles) and thus have a trans-atlantic capability. Extra fuel is stored in a tank between the rear pressure bulkhead and the aft baggage compartment, which is made smaller.

Typical Citation III flights will probably average 925 km (575 miles) with four passengers and a total of 600 hours utilization annually. By the end of 1979 sales were approaching 150, accounting for most production into the mid 1980s. With the Citation III and its popular predecessors Cessna was aiming to capture half the business jet market by 1985.

Citation II

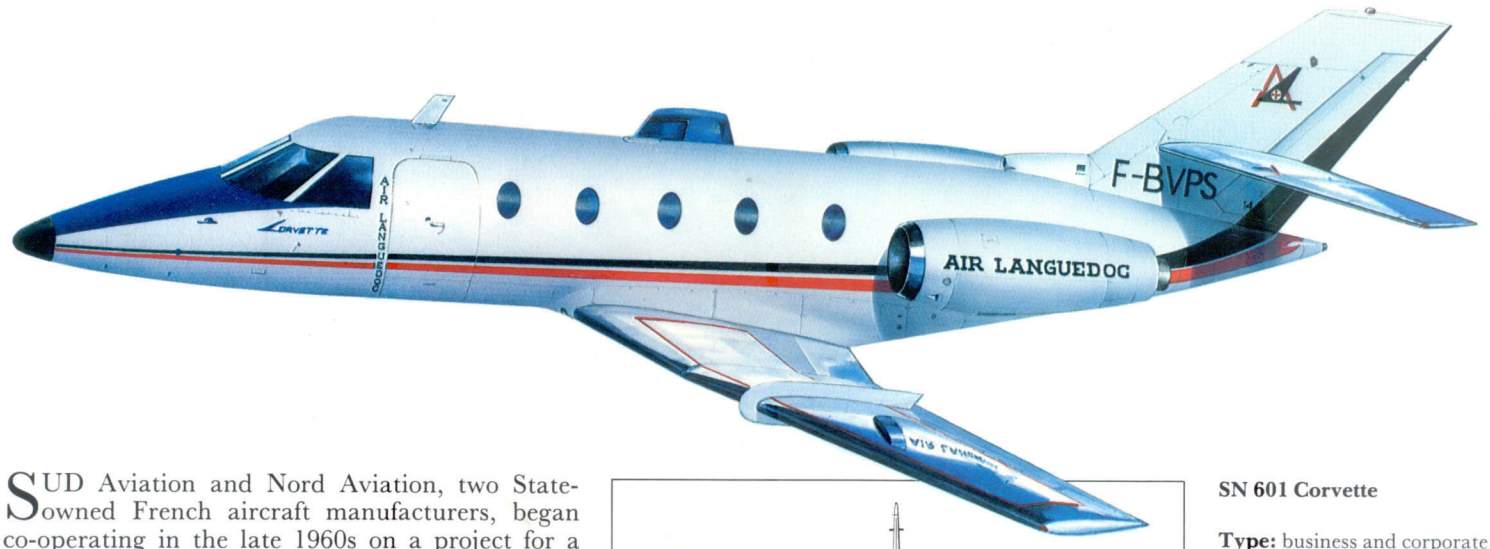


Citation I

Type: executive transport
Maker: Cessna Aircraft Co
Span: 14.35 m (47 ft 1 in)
Length: 13.26 m (43 ft 6 in)
Height: 4.36 m (14 ft 3¾ in)
Wing area: 24.2 m^2 (260 sq ft)
Weight: maximum 5375 kg (11 850 lb); empty 2935 kg (6470 lb)
Powerplant: two 2200-lb (998-kg) st Pratt & Whitney JT15D-1A turbofans
Performance: maximum cruising speed 649 km/h (403 mph) at 7620 m (25 000 ft); range 2474 km (1537 miles)
Payload: seats for 6 passengers
Crew: 2
Production: 150 (1000 of all models)

Corvette, Aérospatiale

FIRST FLIGHT 1970



SUD Aviation and Nord Aviation, two State-owned French aircraft manufacturers, began co-operating in the late 1960s on a project for a light jet business aircraft/commuter airliner designed primarily for the North American market.

Development of the aircraft – designated SN600 – proceeded when the two companies merged into Aérospatiale and the first prototype flew on July 16, 1970, but was destroyed during test flying in March 1971. Two development SN601 prototypes followed, making their maiden flights on December 20, 1972 and March 7, 1973, followed by the first production standard Corvette 100 on November 9, 1973. The all-metal wings are of conventional two-spar fail-safe structure of aluminium alloy. The aluminium alloy ailerons are manually-operated and the double-slotted, long-travel, trailing-edge flaps are electrically-operated. The two Pratt & Whitney Aircraft of Canada JT15D-4 turbofans each generate a static thrust of 1134 kg (2500 lb) and are mounted in pods on either side of the rear fuselage. Standard seating arrangement is for 6 to 14 passengers in single seats on either side of a centre aisle.

Certification of the aircraft was long delayed by a protracted strike at Pratt & Whitney Aircraft of Canada, who supplied the JT15D-4 turbofan engines. The Corvette was finally certificated by the French authorities on May 28, 1974. Most initial customer interest came not from America but from domestic airlines in France. The first customer delivery was made in September 1974 to Air Alpes, who operated the Corvette out of Paris and in Air France colours on the Lyons-Brussels route. In airline service the Corvette had a 12-seat interior and could be equipped with wingtip tanks for extended range.

A planned 18-seat version to be called Corvette 200 proceeded no further than the design stage, and in service the standard Corvette proved too small for its intended role as a commuter airliner. Forty Corvettes had been built when Aérospatiale terminated the programme in 1977; a number remain in airline service with Air Alsace and Touraine Air Transport in France and with operators in Belgium, Holland, Sweden and African states. Refurbished Corvettes for the business market are being marketed by Air National Aircraft Sales and Service Inc of San Jose, California, on behalf of Aérospatiale.

SN 601 Corvette

Type: business and corporate transport
Maker: Société Nationale Industrielle Aérospatiale
Span: 13.7 m (45 ft)
Length: 13.83 m (45 ft 4½ in)
Height: 4.23 m (13 ft 10½ in)
Wing area: 22 m^2 (237 sq ft)
Weight: maximum 6600 kg (14 550 lb); empty 3510 kg (7738 lb)
Powerplant: two 1134-kg (2500-lb) st Pratt & Whitney Aircraft of Canada JT15D-4 turbofans
Performance: maximum cruising speed 760 km/h (472 mph) at 9144 m (30 000 ft); range 2555 km (1588 miles)
Payload: seats for up to 14 passengers
Crew: 2
Production: 40

Top: A Corvette in the colours of Air Languedoc. This small French domestic operator uses aircraft from the Touraine Air Transport fleet and connects Paris (Le Bourget) with Béziers in Languedoc
Below: A Corvette in Aérospatiale livery takes off during a demonstration flight

Nomad, GAF

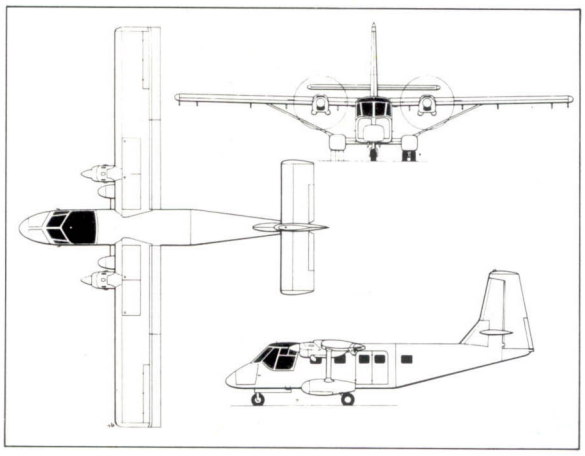
FIRST FLIGHT 1971

IN 1965 Government Aircraft Factories, which is operated by Australia's Department of Industry and Commerce, began studies for a small utility transport aircraft at their headquarters at Fisherman's Bend, near Melbourne. The aircraft was intended both to fulfil civil and military domestic needs for a rugged STOL aircraft and to ensure a level of continued domestic production activity.

The Government-funded prototype aircraft was known as the N2 and made its first flight on July 23, 1971, followed by a second aircraft on December 5, 1971. The aircraft followed conventional utility format in having a square, boxy fuselage and a high wing, and was powered by two Allison turboprop engines. Australian certification was granted on August 11, 1972 and production of the developed N22 Nomad model began immediately. The Nomad's ability to operate from small unprepared airstrips has made it popular with Third World air forces and civilian operators. Most of the short-bodied N22s and N22Bs (with increased gross weight) have been delivered to military operators, including the air arms of Australia, Indonesia, Papua New Guinea and the Philippines. Military Nomads have provision for armour-plating, self-sealing tanks and external armament pods if required. The aircraft can also operate on skis or floats and several Nomads have been so modified.

A stretched N24 Nomad model with seating capacity increased from 12 to 15 passengers (19 in high-density layouts) first flew in 1976 and is intended primarily for commercial operators. The N24A has seats for up to 17 passengers and has a commuter interior and IFR avionics.

The Mission Master is the short-fuselage military version. It is used for maritime surveillance, forward area support and surveillance, and transport by the services of Australia, Papua New Guinea, the Philippines and Indonesia. The latest Nomad model is the maritime-patrol Searchmaster variant of the N22B. The Searchmaster B was introduced in 1975 while the Searchmaster L with Litton LASR-2 search radar, and a flat-plate phased array scanner in an undernose radome, in place of the former's smaller Bendix unit, began testing in 1978. More than 100 Nomads have been delivered and are now operating in Australasia, the Far East, Europe and North America.



N22B

Type: STOL utility transport
Maker: Government Aircraft Factories
Span: 16.46 m (54 ft)
Length: 12.56 m (41 ft 2⅔ in)
Height: 5.52 m (18 ft 1½ in)
Wing area: 30.1 m² (324 sq ft)
Weight: maximum 3855 kg (8500 lb); empty 2116 kg (4666 lb)
Powerplant: two 400-shp Allison 250-B17B turboprops
Performance: maximum cruising speed 311 km/h (193 mph); range with reserves 1352 km (840 miles)
Payload: seats for 15 passengers
Crew: 1
Production: 100 by mid 1979 (of all types)

Below left: The Government Aircraft Factories Nomad was designed to fulfil a civil and military requirement for a STOL machine for freight and passenger transport

Nomad 22

1 Nose baggage compartment
2 Twin landing/taxiing lamps
3 Left rudder pedals
4 Left instrument panel
5 Left control column
6 Underfloor avionics bay
7 Control runs
8 Overhead instrumentation
9 Engine compressor air intake
10 Allison 250-B17 turboprop
11 Wing stringers
12 Wing ribs
13 Right outer fuel tank
14 Engine intake
15 Hinged leading-edge
16 Right inner fuel tank
17 Right wing/centre fuselage attachment points
18 Rear baggage compartment
19 Control runs
20 Aerials
21 Rudder tab
22 Elevator tab
23 Left outer fuel tank
24 Cabin step
25 Exhaust stub
26 One-piece machined stub wing
27 Battery housing
28 Retraction jack
29 Double-slotted flaps
30 Aileron tab
31 Control surface/flap actuating mechanism
32 Main spar
33 Rear spar
34 Left spoiler
35 Left aileron

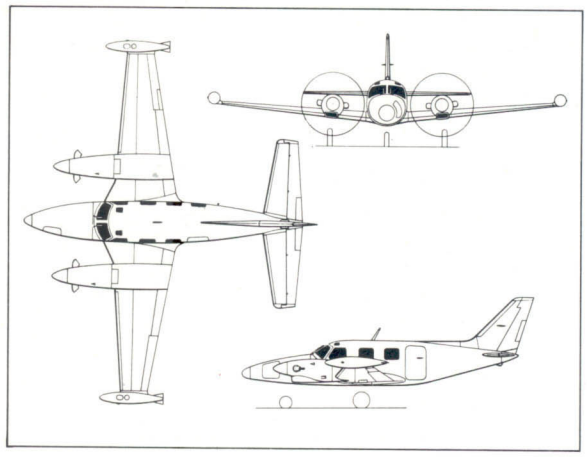
Cheyenne, Piper

FIRST FLIGHT 1969

THREE models comprise the Cheyenne range which grew out of the Piper Navajo family of executive aircraft – the original version (now called Cheyenne II), the smaller, low-cost Cheyenne I, and the much larger Cheyenne III, which features a number of basic changes. (This model now carries the designation Piper PA-42.)

With an airframe very similar to that of the established pressurized Navajo, the Cheyenne introduced turboprop power to the Piper line for the first time. The first flight was in August 1969 with FAA certification coming in May 1972.

Following the introduction of a low-cost version (I) and the stretched model (III), the standard aircraft became the Cheyenne II in 1978. The Cheyenne I differs primarily in having less powerful Pratt & Whitney PT6A engines of 500 shp against the 628-shp units in the II. Internal fuel capacity is slightly reduced, and the wingtip tanks, fitted as standard on the II and III, are optional on this model. Late in 1977 Piper announced the introduction of the third member of the Cheyenne family, the III, which was to feature several significant changes from the two established models. The III has increased wing span – some 1.47 m (4 ft 10 in) greater than the II – a lengthened fuselage, T-tail and more powerful PT6A-41 engines, rated at 680 shp. The Cheyenne III can accommodate up to nine passengers, in addition to pilot and co-pilot, but the aircraft can be operated in a single-pilot configuration. All three Cheyenne models are available in many versions with most of Piper's 'group options' for interior fit and electronics available. The standard cabin packages comprise: individual seats, four-way adjustable crew seats, seatbelts, curtains and wall-to-wall carpets. Tinted windows, a stereo system and leather seat coverings are offered as extras. The executive interior adds reclining seats, drinks storage and dispenser, folding tables, toilet and refreshment centre, including razor socket, and the same extras. Two other packages include a de-icing system comprising pneumatic leading-edge boots for the wing and tailplane and an ice-inspection light, as well as a co-pilot panel of instruments, with alternate static pressure system, toe brakes and windscreen wiper. There is also available a total of seven different factory-installed packages of avionics equipment.



PA-31T Cheyenne II

Type: executive or corporate transport and commuter airliner
Maker: Piper Aircraft Corporation
Span: 13.01 m (42 ft 8¼ in)
Length: 10.57 m (34 ft 8 in)
Height: 3.89 m (12 ft 9 in)
Wing area: 21.3 m² (229 sq ft)
Weight: maximum 4082 kg (9000 lb); empty 2257 kg (4976 lb)
Powerplant: two 620-hp Pratt & Whitney PT6A-28 turboprops
Performance: maximum cruising speed 525 km/h (326 mph) at 3355 m (11 000 ft); range with maximum fuel and 45 min reserves 2557 km (1589 miles)
Payload: seats for up to 6 passengers
Crew: 1
Production: not available

Below: A Piper PA-31T Cheyenne operated by a private owner in California. The Cheyenne comes with a range of interior fittings designed to attract a variety of owners from the airline to the private individual who may demand the highest levels of personal comfort

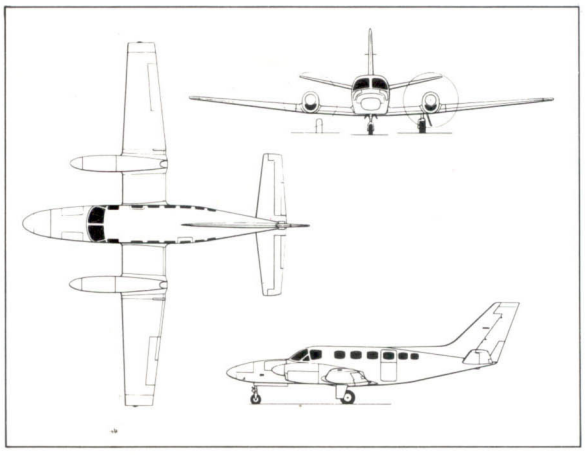
Conquest, Cessna

FIRST FLIGHT 1975

THE first turboprop aircraft to come from the world's most prolific manufacturer, the Conquest was designed for a gap in the business aircraft market between twin piston-engined aircraft and turbofan-powered types. It was announced in late 1974, and the prototype first flew in 1975. Power comes from two 625-shp Garrett-AiResearch turboprop engines specially developed to meet Cessna's high-altitude high-speed requirements. High performance comes in part from the use of a new high-aspect-ratio bonded wing, like that of the Cessna Titan except for an increase in span and area by adding wingtip extensions.

The Conquest is large in comparison with other Cessna twins, weighing 1089 kg (2400 lb) heavier than the 421C Golden Eagle. The fuselage is similar to the Titan's but is strengthened for pressurization, and the Conquest also shares the Titan's high-strength trailing-link hydraulically-retractable landing gear, noted for its very forgiving ride over rough surfaces. Accommodation in the pressurized cabin is for four to ten passengers. There are a variety of seating arrangements available depending on customer requirement with optional extras including refreshment area, toilet, writing tables and stereo system.

Four Conquests had been delivered by the beginning of 1978, but then disaster struck when an elevator-tab actuator failed in flight on an aircraft in service, causing a fatal crash. Cessna grounded all aircraft in service before duplicating the actuator rods. But on a subsequent flight there was a further rod failure, which led to tailplane vibration in the air, but was followed by a successful landing. The FAA withdrew the Conquest's Certificate of Airworthiness pending investigations into the tailplane and elevator design.



Cessna engineers originally intended to strengthen the actuator assembly further, but felt that this would make the sub-assembly too strong in proportion to the surrounding structure. To avoid harmonic distortions the whole structure was redesigned, and the modification embodied by replacing the tailplane. Fifteen extra ribs were added, plus an extra front spar and thicker skin.

After exhaustive flight and ground tests the FAA re-instated the Certificate of Airworthiness in September 1979, subject to installation of the new tailplane on all Conquests.

C-441 Conquest

Type: pressurized executive transport
Maker: Cessna Aircraft Co
Span: 15.04 m (49 ft 4 in)
Length: 11.89 m (39 ft 0¼ in)
Height: 3.99 m (13 ft 1¼ in)
Wing area: 23.6 m² (253.6 sq ft)
Weight: maximum 4468 kg (9850 lb); empty 2535 kg (5589 lb)
Powerplant: two 625-hp Garrett-AiResearch TPE331-8-401S turboprops
Performance: maximum speed 547 km/h (340 mph) at 4875 m (16 000 ft); range 1899 km (1180 miles)
Payload: seats for 10 passengers
Crew: 1
Production: approx 200 by 1980

Below: The aptly registered G-AUTO operated by the British Automobile Association

Skyservant, Dornier

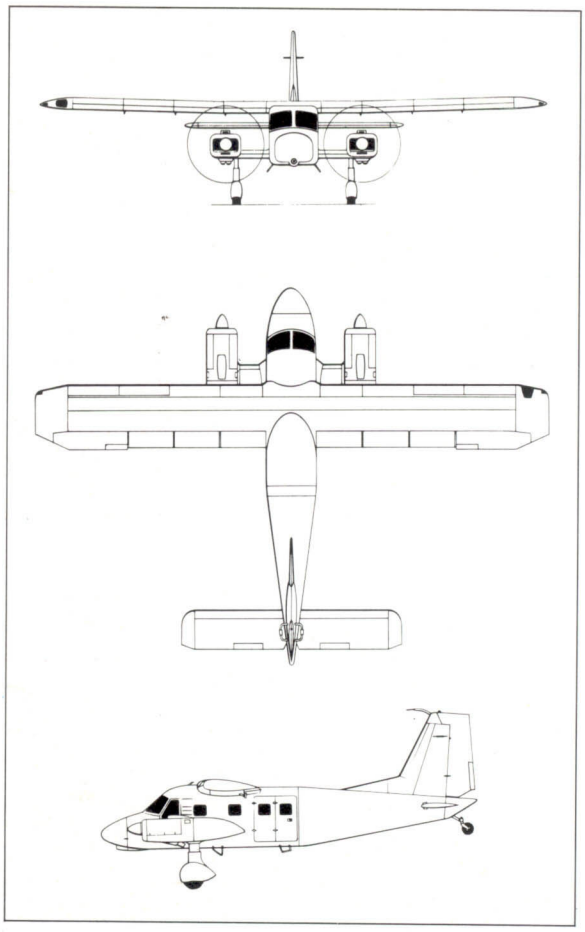
FIRST FLIGHT 1959

FOLLOWING World War II, the initial Dornier project was the Do 25 monoplane, from which was developed a more advanced design, the Do 27. This subsequent type came to be built in Germany, along with a twin-engined variant, designated the Do 28.

The Do 28 was a simple development with the two engines each mounted on a small stub wing alongside the cockpit. Fixed undercarriage units are suspended beneath each powerplant. Two 180-hp Lycoming IO-360s were chosen for the prototype, which first flew in 1959.

A second aircraft, powered by Lycoming IO540s of 250-hp, featured increased wing span. Initial production versions which began to appear in 1960 had seating for seven passengers. Professor Dornier achieved the type's famous STOL (short take-off and landing) characteristics by the use of fixed slats over the whole span, double-slotted flaps, and with the inner aileron portions drooped. A wheel/ski undercarriage was available, while a floatplane conversion was developed in Canada. Versions featuring increased power from turbocharged engines, increased gross weight and payload were developed, and one proposal featured pressurization and turboprop engines. A new fuselage section was introduced for the Do 28 D Skyservant seating up to 12 passengers and with a 1.48-m^2 (16-sq ft) door on the left side. The first flight in 1966 and type approval a year later was followed in 1968 by FAA (Federal Aviation Administration) certification. The Do 28 D-1 included increased wing span and gross weight. Records for piston-engined business aircraft in the 3000–6000 kg (6615–13 230 lb) range were established for altitude, payload and time-to-height.

Several aerodynamic and other detail design changes have been introduced in the Do 28 D-2 including another increase in gross weight, dual controls and a dual braking system. This version is powered by two Lycoming IGSO-540 engines of 380 hp. An all-flying one-piece tailplane is installed and the variant is available in float or wheel/ski undercarriage layouts. The type is in major service as a corporate or executive transport, as a commuter and third-level airliner, and as an airtaxi. It is extensively used by governments and military services all over the world. A turboprop variant, the Do 28 D-5 TurboSky, powered by two Lycoming LTP101 engines of 620-ehp, flew in April 1978.



Do 28 D-2

Type: STOL transport and utility aircraft
Maker: Dornier GmbH
Span: 15.55 m (51 ft 0¼ in)
Length: 11.41 m (37 ft 5¼ in)
Height: 3.9 m (12 ft 9½ in)
Wing area: 29 m^2 (312 sq ft)
Weight: maximum 4015 kg (8853 lb); empty 2328 kg (5132 lb)
Powerplant: two 380-hp Lycoming 1GSO-540-A1E flat-six engines
Performance: maximum speed 325 km/h (202 mph) at 3050 m (10 000 ft); range with maximum payload 1052 km (652 miles)
Payload: seats for 13 passengers(or 5 stretchers and 5 seats)
Crew: 1
Production: minimum 200

Top: A Swedish-registered Dornier Skyservant in service with the International Red Cross. This versatile aircraft is ideal for work in underdeveloped countries
Above: A Skyservant on a grass airstrip in the summer of 1969

Xingu, Embraer

FIRST FLIGHT 1976

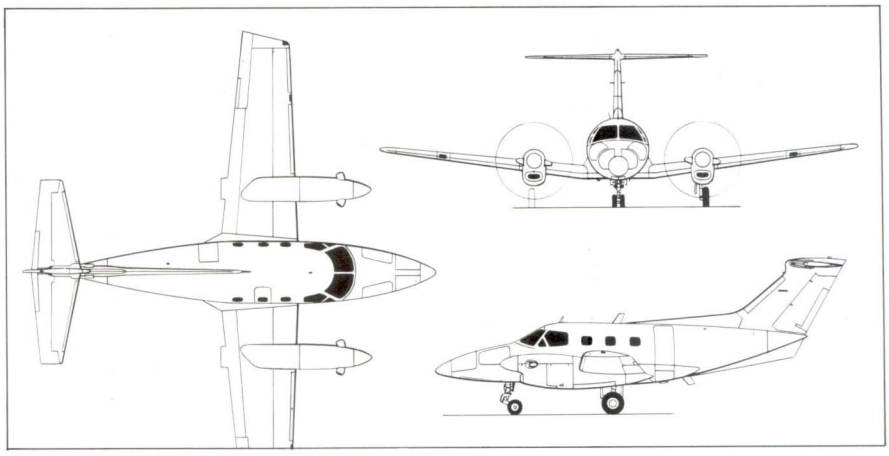
FOLLOWING the successful introduction of their EMB-110 Bandeirante light transport aircraft, Empresa Brasileira de Aeronautica of São Paulo, Brazil drew up plans in the early 1970s for a series of derivatives of the Bandeirante design. The first to appear is the Embraer EMB-121 Xingu. The Xingu is a pressurized twin-engine turboprop business aircraft which has a new, shorter fuselage of circular cross-section, clipped Bandeirante wings, more powerful Pratt & Whitney of Canada PT6A engines and a fashionable T-tail. A six-seat prototype was flown for the first time in October 1976 followed by a production standard machine on May 20, 1977.

First customers for the Xingu were the VIP transport flight of the Brazilian air force based at Brasilia, who took six early production aircraft, and the Brazilian racing driver Emmerson Fittipaldi. The Xingu was awarded type certification by the Brazilian Centro Technico Aeroespacial in the summer of 1979 and immediately South America's biggest air-taxi operators, Lider Taxi Aereo of Brazil, ordered six aircraft prior to the Xingu's official market launch.

Though less elegant externally than its American counterpart, the Beech King Air 90, Embraer's Xingu offers a roomy cabin for up to six passengers and can cruise at speeds up to 463 km/h (288 mph) at altitudes above 3048 m (10 000 ft).

Two further developments of the Xingu airframe are planned: the EMB-120 Araguaia with a stretched fuselage accommodating up to 20 passengers; and the EMB-123 Trapajos again with a lengthened cabin accommodating ten passengers, but with a new wing of supercritical airfoil section and tiptanks. Both aircraft will be powered by uprated Pratt & Whitney of Canada PT6A-45 turboprops. With the Xingu variants Embraer – already a leading world General Aviation manufacturer – hope to capture a share of the low-volume/high-value business turboprop market, which is the fastest growing General Aviation sector and is currently almost entirely US-dominated.

Notable among the Xingu's achievements in a short career to date was the first flight over the North Pole by a Brazilian-manufactured aircraft when an early demonstrator returned to the factory from Europe via the Polar route on September 28, 1977.



EMB-121 Xingu

Type: business and corporate transport
Maker: Empresa Brasileira De Aeronauta SA
Span: 14.45 m (47 ft 5 in)
Length: 12.25 m (40 ft 2¼ in)
Height: 4.74 m (15 ft 6½ in)
Wing area: 27.5 m² (296 sq ft)
Weight: maximum 5670 kg (12 500 lb); empty 3500 kg (7716 lb)
Powerplant: two 680-shp Pratt & Whitney of Canada PT6A-28 turboprops
Performance: maximum cruising speed 450 km/h (280 mph); range 2352 km (1461 miles)
Payload: seats for up to 9 passengers
Crew: 2
Production: 16 ordered by mid 1979

Left: The Embraer EMB-121 Xingu; the type has proved popular with air-taxi operators including Lider Taxi Aereo of Brazil

Challenger, Canadair

FIRST FLIGHT 1978

THE Learstar 600, was designed to carry 14 passengers over 5550 km (3450 miles) cruising at 15 240 m (50 000 ft). The fuselage was planned to be very spacious, seating three-abreast when laid out as a small airliner. Bill Lear's original objective was a low-cost, long-range aircraft which would outperform every type in its class.

Canadair accepted the project in 1976 and widened the fuselage still further, increasing the weight. The engines selected were geared turbofans by Avco Lycoming producing 3402 kg (7500 lb) thrust. The design was named Challenger in 1976, and with orders of over 50 in that first year Canadair and the Canadian Government committed large sums to the project.

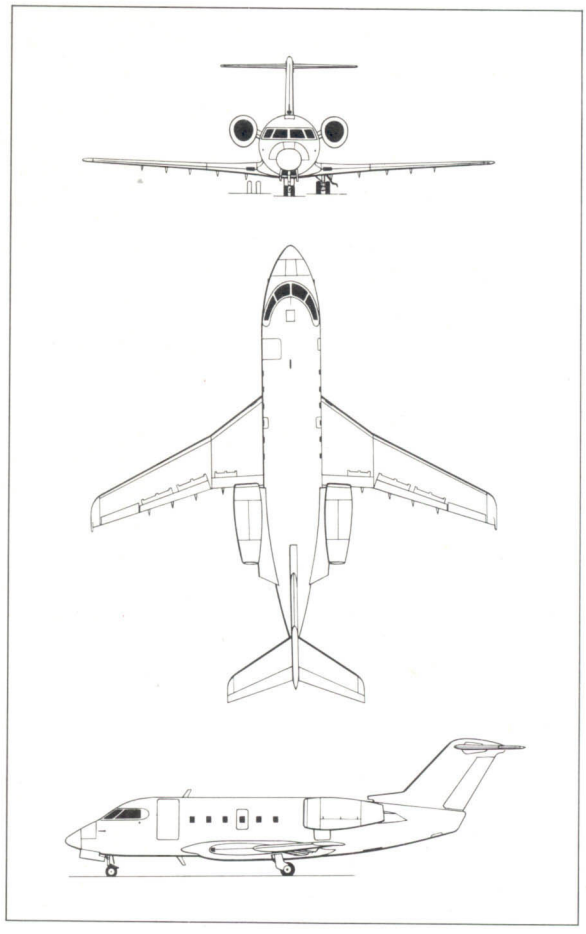
The Challenger promised a remarkable performance that includes the ability to fly from short runways and cruise for long distances in airline-style speed and comfort. Take-off from a 1524-m (5000-ft) runway can be accomplished at maximum weight, and the aircraft is designed for high-altitude cruising over most commercial jet airliner routes.

Maximum cruise altitude is 14 935 m (49 000 ft), and performance claims include the ability to reach 12 497 m (41 000 ft) 17 min after take-off at maximum weight. Range has been quoted at over 7400 km (4600 miles), beating all the other top-performing business jets such as the Falcon 50, Jetstar II and Gulfstream II.

By mid 1978 orders for the executive version were over 100, and performance figures (with tolerances) had virtually been guaranteed. Minimum level speed at 10 973 m (36 000 ft) is over 925 km/h (575 mph). Take-off and landing guarantees are below 1524 m (5000 ft). The 1979 price was over $8 million, but that was for a comprehensive package deal, including personnel training and maintenance.

Construction of three pre-production Challengers began in April 1977 and the first roll-out took place in May 1978. First flight was made in November 1978, only two years after the programme got its official go-ahead.

A stretched version of the Challenger has been developed, called the Challenger E. This extends the fuselage by some 2.75 m (9 ft), to give a major weight increase to 22 226 kg (49 000 lb) and a range of 8520 km (5294 miles). The wing will be modified to include high-lift devices on the leading edges.



Challenger

Type: business, cargo and commuter transport
Maker: Canadair Ltd
Span: 18.85 m (61 ft 10 in)
Length: 20.85 m (68 ft 5 in)
Height: 6.3 m (20 ft 8 in)
Wing area: 41.8 m^2 (450 sq ft)
Weight: maximum 16 329 kg (36 000 lb); empty 7711 kg (17 000 lb)
Powerplant: two 7500-lb (3402-kg) st Avco Lycoming ALF 502L turbofans
Performance: maximum speed 925 km/h (575 mph) at 14 935 m (49 000 ft); range with IFR reserves and 426 kg (940 lb) payload 8246 km (5124 miles)
Payload: 3400 kg (7500 lb); seats for up to 14 (Challenger E, 40) passengers
Crew: 2
Production: 120 ordered by June 1979

Below: A pre-production Challenger with an instrumentation antenna in the nose and the X registration indicating an experimental model
Bottom: the Challenger can operate off short runways, but offers airline-style comfort

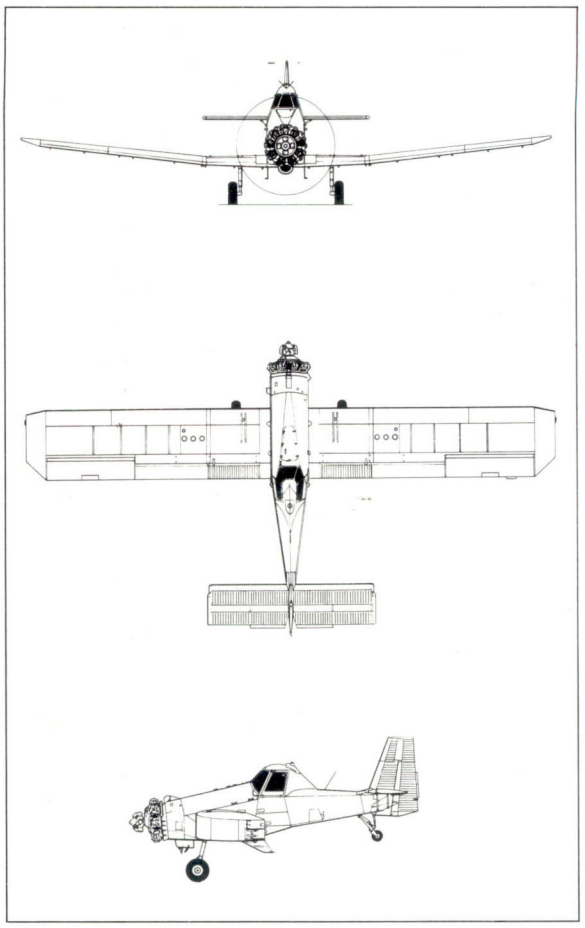
Dromader, PZL

FIRST FLIGHT 1976

DESIGNERS at the Wytwornia Sprzetu Komun Ikacyjnego PZL (transport equipment manufacturing centre) at Mielec, Poland, designed the PZL M-18 Dromader (Dromedary) to fill the gap in their agricultural aircraft range between the smaller 106A Kruk and the M-15 Belphegor jet biplane. To save time in development, and with an eye to the export market, PZL sought the co-operation of American manufacturers Rockwell International, and used the outer-wing panels, cabin area and other components from the Rockwell International S2R Thrush Commander.

Particular attention was paid to pilot safety in the design, the cockpit area being strengthened to withstand a 40 g impact without collapsing, and all fuel being carried in the outer-wing panels, well away from the pilot. These fuel tanks have a combined usable capacity of 400 litres (88 Imp gal). The structure, where exposed to possible contamination by chemicals, was treated with polyurethane or epoxy enamels or fabricated from stainless steel, and the welded-tube fuselage framework filled with anti-corrosive oil. The glassfibre epoxy hopper can accommodate either liquid or dry chemicals. With a payload of 2600 kg (5732 lb) and a hopper capacity of 2500 litres (550 Imp gal), the Dromader is one of the world's largest purpose-built agricultural aircraft. It is also one of the most powerful, having a 1000-hp Polish-built ASz-62IR radial engine of the type fitted to the Soviet Antonov An-2 biplane which the Dromader will hopefully replace in some Eastern bloc countries. This supercharged engine drives a PZL Warszawa AW-2-30 four-blade constant-speed aluminium propeller.

The first prototype Dromader made its maiden flight on August 27, 1976, and made its western debut at the 1977 Paris Air Show. Before the type received its Polish certificate on September 27, 1978, ten pre-series aircraft were built. Two of these were employed for static and fatigue testing and five for operating trials. In the summer of 1978 two were used for spraying and dusting Egyptian cotton. Apart from its prime role as a crop-duster/sprayer, the aircraft can also be equipped with Rockwell-developed water bombing/fire-fighting equipment. Indeed, a fire-fighting version of the Dromader was flown for the first time on November 29, 1978.



M-18 Dromader

Type: agricultural aircraft
Maker: Wytwornia Sprzetu Ikacyjnego PZL-Mielec
Span: 17.7 m (58 ft 0¾ in)
Length: 9.48 m (31 ft 1¼ in)
Height: 3.1 m (10 ft 2 in)
Wing area: 40 m² (430.56 sq ft)
Weight: maximum 4200 kg (9259 lb); empty 2560 kg (5644 lb)
Powerplant: one 1000-hp PZL Kalisz ASz-62IR 9-cylinder supercharged radial air-cooled engine
Performance: maximum cruising speed 190 km/h (118 mph); range 520 km (323 miles)
Payload: chemical spraying equipment, capacity 2500 litres (550 Imp gal) or 1500 kg (3307 lb)
Crew: 1
Production: 60 ordered by the end of 1979

Left: A Dromader buzzes the crowd at the Paris exhibition of 1977
Below: The Dromader is one of the world's largest purpose-built agricultural aircraft, capable of lifting 2500 litres (550 Imp gal) or a payload of 2600 kg (5732 lb). Besides crop-dusting the Dromader can be used for fire-fighting using equipment designed by the American manufacturers Rockwell International

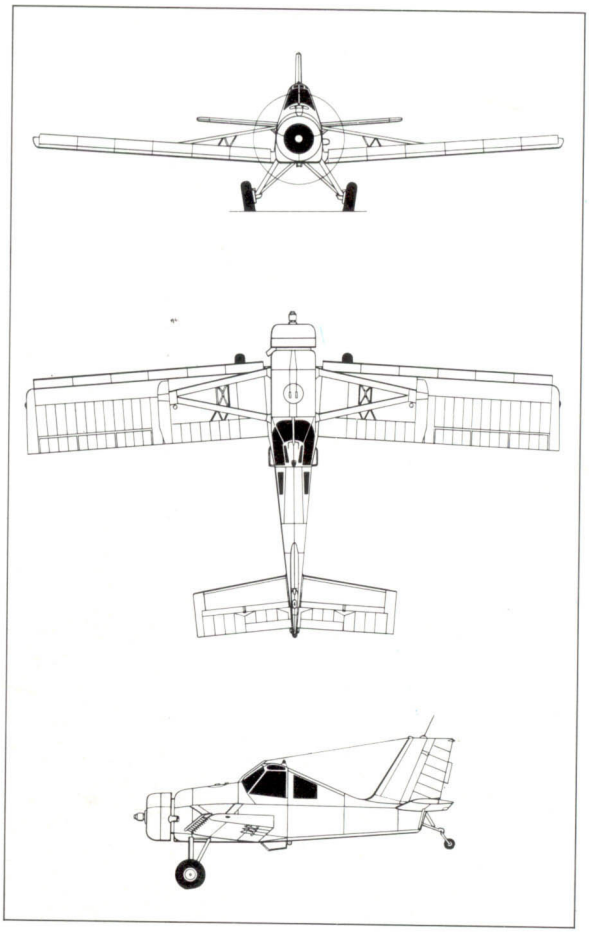
Kruk, PZL

FIRST FLIGHT 1973

STUDIES for a replacement for the Polish PZL-101A Gawron agricultural and utility aircraft began at WSK-Okecie in the early 1960s under the leadership of Andrzej Frydrychewicz. Initially an extensive redesign of the high-wing Gawron was planned and a 260-hp AI-14R radial-engined prototype designated PZL-101M Kruk (Raven) was flown. By 1972 the design team elected instead to produce a more powerful version in the braced low-wing configuration favoured by agricultural operators in the West, and the first such prototype, designated PZL-106, flew on April 17, 1973 in the hands of test pilot Jerzy Jedrzejewski. This and a second prototype were powered by 400-hp Lycoming IO-720 engines; four more prototypes were tested with 600-hp PZL-3S seven-cylinder radial engines and this powerplant was chosen for the PZL-106A production model, manufactured at Centrum Naukowo Produkayjne Samolotow Lekkich PZL-Warszawa (Light Aircraft Science and Production Centre, Warsaw).

The Kruk has distinctive, slightly swept wings, set far forward to counteract the weight of the engine and features an advanced, corrosion-proofed structure whose fuselage is skinned with quick-release glass-reinforced plastic panels for ease of access for maintenance and cleaning. The hopper can release 1000 kg (2205 lb) of chemicals in less than 5 sec. Liquid chemicals are distributed by means of a fan-driven centrifugal pump. Fuel is carried in two wing tanks with a total capacity of 310 litres (68 Imp gal). The cockpit is air-conditioned and stressed to withstand a 40 g impact. A rearward-facing seat behind the pilot's enables a mechanic/loader to be ferried to work sites, making the Kruk largely independent of ground support.

Production started in 1976, with the first export aircraft going to Hungary in 1977. The total requirement for Kruks from the Council for Mutual Economic Aid (CMEA) countries is expected to exceed 600 aircraft. A two-seat trainer version and an uncowled tropical model of the Kruk have been developed. The two-seat version has dual controls and a 400-litre (88-Imp gal) hopper and this facility is available on any production PZL-106A. The latest version, the PZL-106AR, was flown for the first time on November 15, 1978 and is equipped with a geared PZL-3SR engine.



PZL-106A Kruk

Type: single-engine agricultural aircraft
Maker: Centrum Naukowo Produkayjne Samolotow Lekkich PZL-Warszawa
Span: 14.8 m (48 ft 6½ in)
Length: 9.10 m (29 ft 10 in)
Height: 3.32 m (10 ft 10¾ in)
Wing area: 28.4 m² (306 sq ft)
Weight: maximum 3000 kg (6614 lb); empty 1575 kg (3472 lb)
Powerplant: one 600-hp Pezetel PZL-3S radial engine
Performance: maximum speed 211 km/h (131 mph); range 400 km (248 miles)
Crew: 1
Production: 600 anticipated

Top: The PZL-106 showing its underwing spray boom. Like most modern crop-sprayers it has a skin designed to resist penetration or contamination by chemicals
Above: A PZL Kruk (Raven) flies low over the runway at Farnborough in September 1976

IAR-827

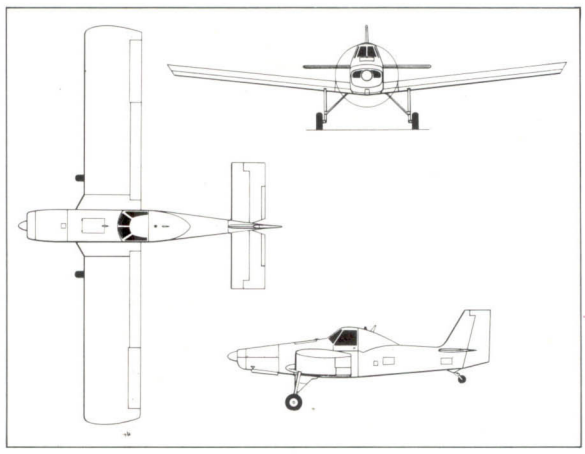
FIRST FLIGHT 1970

THE IAR-827 is the latest in a line of agricultural aircraft produced by the Intreprinderea de Constructii Aeronautice at Brasov in Romania. The first, IAR-821, was designed at the former Industrial Aeronautica Romana works and flew for the first time in 1967, with series production commencing at IRMA (Aircraft Repair Factory) the following year. The IAR-821 was powered by a 300-hp Ivchenko radial engine.

In October 1968 design started on the improved IAR-822 which first flew in March 1970 with a 290-hp Avco Lycoming IO-540-G1D5 engine. Five pre-production aircraft and 200 series production examples were manufactured before the wood/metal IAR-822 and two-seat IAR-822B were superseded by the all-metal IAR-826 in 1973. Produced both for domestic and export markets, the IAR-826 serves as an agricultural aircraft, glider tug, (up to three sailplanes can be towed simultaneously) aerial-survey aircraft, fire-fighter, pipeline patroller, highway de-icer, trainer and light cargo or mail carrier (in which role the agricultural hopper can be replaced with a 700-kg 1543-lb cargo container).

The IAR-827 is a developed version of the all-metal IAR-826 designed in 1973 by Dipl Ing Radu Manicatide. His aim was to produce an agricultural aircraft with an airframe life of 4000 hours or 22 000 flights which could carry 2 kg per hp of payload, with an airframe expressly designed to minimize damage from chemical corrosion in the field.

The first IAR-827 was powered by a 400-hp Avco Lycoming IO-720 engine which drove a Hartzell two-blade constant-speed metal propeller with spinner. The fuel is carried in tanks in each leading edge with a capacity of 100 litres (22 Imp gal) each. It featured increased payload and improved operating and handling characteristics over earlier models. Accommodation was for pilot and mechanic in side-by-side seats in a fully-enclosed, heated and ventilated cockpit. It made its first flight on July 22, 1976 but trials revealed that more power was needed and production was delayed while the prototype aircraft were re-engined with 600-hp PZL-3S radial engines. Thus powered the IAR-827 will be able to carry 800 kg (1763 lb) of dry chemicals or 1200 litres (264 Imp gal) of liquids. A two-seat version for training or ferrying is flying in Romania.



IAR-827

Type: agricultural aircraft
Maker: Intreprinderea de Constructii Aeronautice, Brasov
Span: 14 m (45 ft 11¼ in)
Length: 9.6 m (31 ft 6 in)
Height: 2.6 m (8 ft 6½ in)
Wing area: 29 m² (312 sq ft)
Weight: maximum 2350 kg (5180 lb); empty 1280 kg (2822 lb)
Powerplant: one 400-hp Avco Lycoming IO-720-DA1B flat-eight engine
Performance: maximum cruising speed 175 km/h (109 mph)
Payload: 1070 kg (2358 lb)
Crew: 1 to 2
Production: not available

Below: The IAR-822 at an air display in May 1972. This aircraft built in wood and metal was followed by the all-metal IAR-827. They are used for a vast variety of work which includes mail carrying and highway de-icing

Commander 700, Rockwell

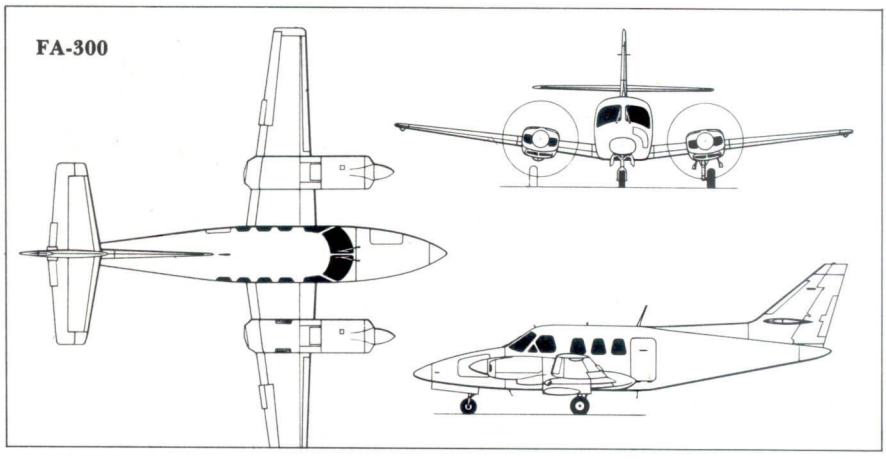
FIRST FLIGHT 1975

FUJI Heavy Industries of Japan began design of this pressurized wide-body twin engine business aircraft in 1971 as part of a diversification programme for their general aviation aircraft line. Three years later the company entered into an agreement with Rockwell International's General Aviation Division whereby the American company would share development, and would assume responsibility for marketing the aircraft in the US.

Six development and certification prototypes were planned, three in each country. The prototype Fuji FA-300 flew for the first time on November 13, 1975; the first Rockwell-assembled Model 700 made its first flight on February 25, 1976, and following US FAA (Federal Aviation Administration) certification in 1977, the aircraft replaced the heavier Commander 685 on the Rockwell production line.

With its capacious fuselage the Rockwell 700 offers an uncommonly roomy cabin for 6 to 7 passengers, with comfort rivalling that of larger aircraft. The pressurization system maintains sea level altitude conditions to 3810 m (12 500 ft) and provides an 1830 m (6000 ft) cabin environment to 6100 m (20 000 ft). Customer deliveries began behind schedule late in 1978, but the well engineered airframe proved heavy and underpowered with the 340-hp Lycoming piston engines, and, with a full load of passengers, range was severely compromised for all but short-haul journeys. The fuselage is constructed mainly from aluminium alloy and the tail unit has swept-back vertical surfaces and shallow dorsal fin. There is a built-in airstair in the left side of the fuselage. In Japan an uprated 450-hp version known as the Fuji FA-300 Kai (Rockwell 710) made its first flight on December 22, 1976 and has since appeared with a number of modifications, including Whitcomb winglets. Rockwell have not taken up their option to produce this aircraft.

By early 1980 deliveries of Rockwell 700s had totalled only 29 aircraft, and the American company announced the termination of its joint development and marketing agreement. Rockwell have continued to support Model 700 operators and have continued to assemble from existing shipsets of Japanese components during 1980, but any future production will be concentrated in Japan.



Commander 700

Type: business and corporate transport
Maker: Rockwell International General Aviation Division; Fuji Heavy Industries
Span: 12.94 m (42 ft 5½ in)
Length: 12.03 m (39 ft 5¾ in)
Height: 4.05 m (13 ft 3½ in)
Wing area: 18.6 m² (200 sq ft)
Weight: maximum 3151 kg (6947 lb); empty 2134 kg (4704 lb)
Powerplant: two 340-hp Avco Lycoming TIO-540-R2AD turbocharged flat-six engines
Performance: maximum speed 409 km/h (254 mph) at 5180 m (17 000 ft); range with full tanks and 45 min reserves 2226 km (1384 miles)
Payload: seats for 6 passengers
Crew: 1
Production: 29 ordered by 1980

Left: A Rockwell 700 at an air display in May 1978. Originally designed in Japan the aircraft is assembled at Rockwell's Bethany factory in Oklahoma, and in Japan as the Fuji FA-300

ST-600, Foxjet

ESTIMATED FIRST FLIGHT MID 1980s

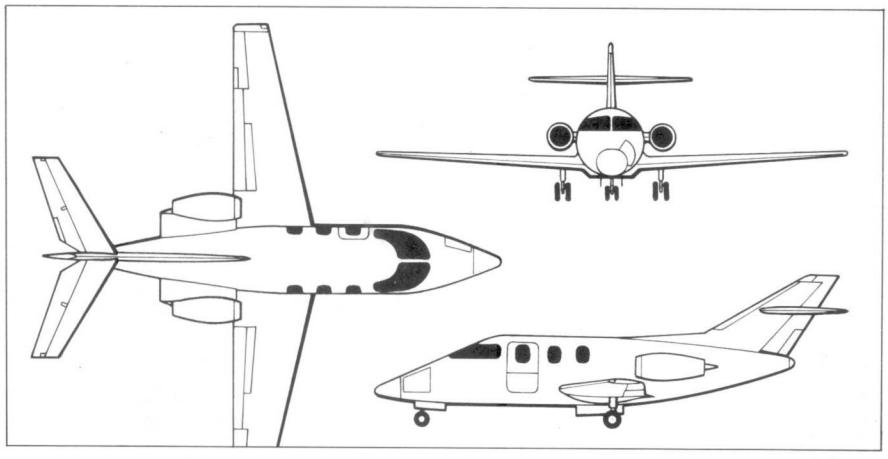
ST-600-S/8

Type: business transport
Maker: Foxjet International Inc
Span: 9.64 m (31 ft 7½ in)
Length: 9.7 m (31 ft 10 in)
Height: 3.12 m (10 ft 2¾ in)
Wing area: 11.61 m^2 (125 sq ft)
Weight: maximum 2064 kg (4550 lb); empty 1092 kg (2408 lb)
Powerplant: two 800-lb (363-kg) st Williams Research WR44-800 turbofans
Performance: maximum cruising speed 659 km/h (410 mph) at 11 000 m (36 000 ft); range 1768 km (1099 miles)
Payload: seats for 6 passengers
Crew: 1
Production: 140 ordered by mid 1980

BUSINESS jets, which are the fastest and probably most glamorous way for the executive to travel, usually seat at least eight people. The Foxjet therefore raised a lot of eyebrows when it was announced in the spring of 1977, since it was designed to seat only four to six people.

It was conceived by Tony Fox of Tony Team Industries (later Fox Industries) who set up a subsidiary company, Foxjet International, to develop and market the project. One of his original aims was to provide a high-speed answer to the fuel shortage, since he claimed a fuel cost of 6 cents per km (9 cents per mile), or a range of about 2.5 km per litre (7 miles per Imp gal). Early performance claims included a cruising speed of 531 km/h (330 mph) at 11 890 m (39 000 ft) for up to 2253 km (1400 miles). Power was to have been provided by two Williams Research WR19-3 turbofans, each of 258 kg (570 lb) thrust and weighing only 30 kg (67 lb), but these were later developed to give 40% more thrust and the original dimensions were scaled up to seat up to six rather than four people. Together with these changes went a new wing, with reduced sweepback and higher aspect ratio, designed by the Branson Aircraft Corporation. This was based on supercritical aerodynamic principles and should improve low-speed control, stability and all-round performance.

The Foxjet is of conventional all-metal construction, and has a traditional business jet appearance with rear-mounted engines and swept-back tail surfaces. Cabin pressurization gives a 'cabin altitude' equivalent to 3048 m (10 000 ft) at 12 190 m (40 000 ft). A two-piece clamshell door also acts as a step, and gives access to a luxuriously appointed cabin with individual bucket seats trimmed in tufted velour.



Standard features include two wheels for each undercarriage leg and a one-man 'power towbar' for easy ground handling. Firm orders for some 100 aircraft, backed up by deposits, had been received by the end of 1978, and further engine developments were envisaged. By the end of 1979, however, the prototype still had not flown, although full-size gleaming Foxjet mock-ups had received plenty of exposure at American trade airshows, along with publicity for Fox Industries' several other very successful products in the fields of refuse control and power tools.

Top left: Designer Tony Fox (on the right) watches as an ST-600 is refuelled. The aircraft has been designed with an emphasis on fuel conservation and operates at 6 cents per km (9 cents per mile)

M-15 Belphegor, PZL

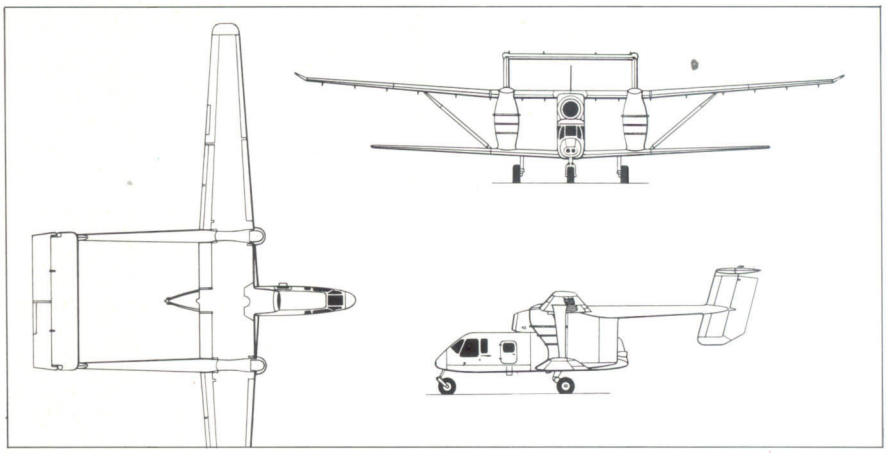
ESTIMATED FIRST FLIGHT 1973

IN 1971 an agreement was concluded between Poland and the Soviet Union whereby Poland would develop and manufacture new agricultural aircraft for use in Soviet-bloc countries. A joint Soviet/Polish design team headed by R A Ismailov and K Gocyla began work at Wytwornia Sprzetu Komun Ikacyjnego PZL (the transport and equipment manufacturing centre) at Mielec, Poland on a revolutionary and unique design – a jet-powered biplane.

An aerodynamic prototype or 'flying laboratory' designated LLP-M15 was first flown on May 20, 1973 and was followed on January 9, 1974 by the first representative M-15 airframe. By any standards it was an odd-looking machine, its outdated biplane configuration having been dictated by the need for the low wing-loading demanded by a slow-flying aircraft with high take-off weight. As a result the M-15 is not only the world's only jet biplane to date (and likely to remain so), but is also the world's largest specialist agricultural aircraft, having a capacity for a massive 2200 kg (4850 lb) of dry chemicals or 2900 litres (640 Imp gal) of liquid insecticide carried in containers, forming struts between the wings and providing a swath width of nearly 61 m (200 ft). The wings are constructed mainly of aluminium alloys and steel with glassfibre laminates and the upper wing is fitted with five fuel tanks. The Ivchenko AI-25 turbofan is mounted in a pod on top of the fuselage.

Five pre-production aircraft from an initial batch of 20 were sent to the Soviet Union in April 1975 for evaluation trials and series production got under way later that year. The M-15 Belphegor made its western debut at the Paris Air Show in 1977, where incredulous observers watched it fly at speeds down to 145 km/h (90 mph), and some cynics were heard to observe that with such an ugly aircraft chemicals were unnecessary – just fly it low and frighten the bugs to death!

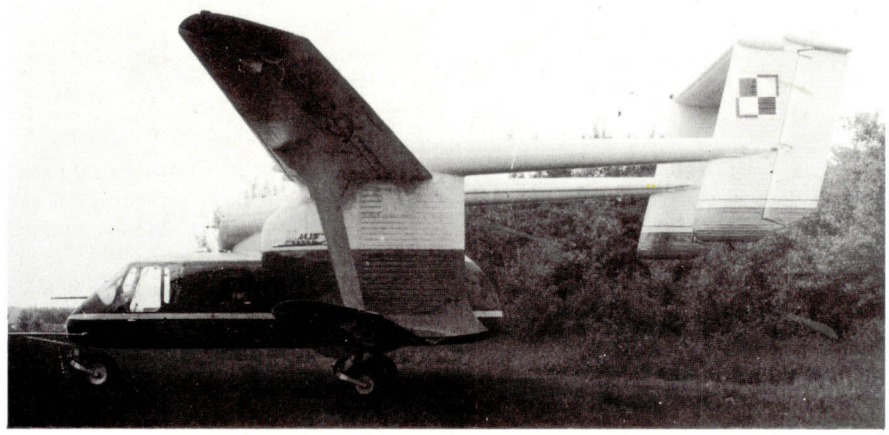
To date all production of the M-15 at Mielec has been for a massive Russian order of some 3000 aircraft to replace the ageing Antonov An-2 biplanes in Aeroflot's agricultural fleet as support for the USSR's five-year agricultural plans. Production of the jet biplane is believed to be running at up to four aircraft a week, and fire-fighting and cargo-carrying versions are believed to be under development.



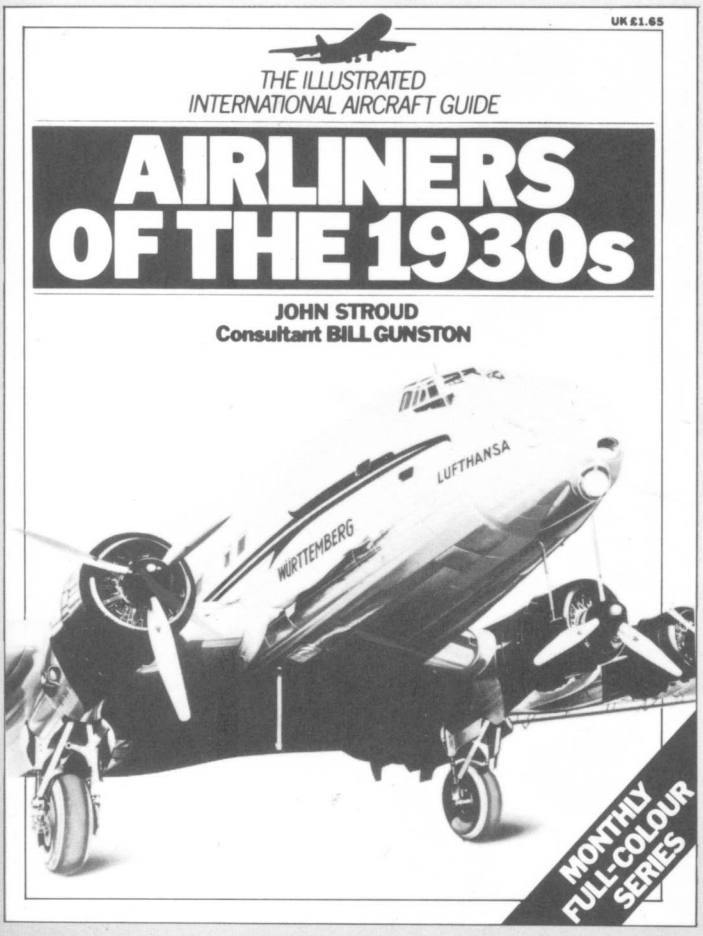
M-15 Belphegor

Type: agricultural aircraft
Maker: Wytwornia Sprzetu Ikacyjnego PZL-Mielec
Span: 22.33 m (73 ft 3 in)
Length: 13.14 m (43 ft 1 in)
Height: 5.34 m (17 ft 6¼ in)
Wing area: 67.5 m^2 (727 sq ft)
Weight: maximum 5750 kg (12 456 lb); empty 3230 kg (7120 lb) dusting, 3270 kg (7210 lb) spraying
Powerplant: one 1500-kg (3307-lb) st Ivchenko AI-25 turbofan
Performance: maximum cruising speed 200 km/h (124 mph); range 400 km (248 miles)
Payload: chemical spraying equipment, capacity 2900 litres (638 Imp gal) or 2200 kg (4850 lb)
Crew: 1
Production: approx 3000 ordered by 1980

Right and below: The unique PZL M-15 is not only the world's first jet biplane, but also the largest specialized agricultural aircraft. Despite its odd looks it has proved to be successful in a variety of roles besides agricultural work



COMING NEXT MONTH...



Contents include

Boeing 247
(cutaway drawing & full-colour artwork)

Armstrong Whitworth Ensign
(cutaway drawing & full-colour artwork)

Potez 62
(full-colour artwork)

SM.83 Savoia-Marchetti
(full-colour artwork)

Short Empire Flying boat
(full-colour artwork)

Nakajima AT-2
(full-colour artwork)

Bloch 220
(full-colour artwork)

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